THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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EFFICIENCY IN MANUFACTURE.

IN another column we give a short account of the proposals recently made by Mr. Ben H. Morgan, primarily for the more efficient utilisation of skilled and other male labour, and ultimately for the improvement of the general standard of efficiency in engineering manufactures. They have already been considered at three meetings of the Institution of Mechanical Engineers, and elsewhere have attracted considerable attention among manufacturers. As yet, however, they do not seem to have led to the adoption of practical measures; and we refer again to the subject, because we believe it to be of fundamental importance to engineering industry, and in particular to those engaged in electrical engineering, who since the inception of the industry have ever been among the most progressive and reflective of engineers.

For the time being, indeed, the subject is even more important to the nation, as a whole, than to any trade or section of it. The war is a continuing catastrophe: the most appalling that can be conceived short of an indecisive peace. The sacrifice that the country makes for each average day by which the war is prolonged, if it occurred in a single day of peace, would horrify the entire civilised world. The agony can be ended only by the concentration of man power and military resources in such overwhelming preponderance as to break down the enemy's means of resistance; and to such extent as the attacking force falls short of such preponderance the war is prolonged, and the day's awful sacrifice is made without equivalent result. Literally, therefore, as a matter of life and death, the country's military services need every man who can be spared; and the equipment and transport of these forces, and those of their Allies, are straining the fullest resources of engineering industry. Military demands must necessarily take account of the apparent limits to the men and equipment that the country can provide; and if through inefficient use of labour men are kept from the technical and other services of the Army, or ships and munitions of war are not supplied in such quantities as they might be, the demands of the military authorities will be artificially restricted through misapprehension of what the country could provide. If, either through such misapprehension or through failure of industry to provide what is asked for, the supplies of men, transport, and equipment provided fall short of what they might have been, the war is to that extent prolonged. That is the nation's interest in the efficient utilisation of labour.

The Government may or may not know whether the country's skill, man-power, and woman-power are being used efficiently, but the public clearly cannot know except by inference. The inferences that engineers can draw to-day are not encouraging. The shipbuilding industry, which must possess very many times the number of skilled shipbuilders that there are in America, is nevertheless unable to

produce the same tonnage as the improvised yards of the United States. Manufacturers in all parts of the country complain that output in their shops is being restricted in defiance of the Munitions Acts. From time to time accounts are published of bargains made with Trade Unions, which reveal plainly that with an equal disregard of those Acts and of national necessities men and women are even now being restricted in the operations they may perform. Strikes occur, and more are threatened, even among workers who are making munitions of the utmost importance to the nation's Forces. And in face of these daily incidents in industrial life, the Government has often maintained an attitude of benevolent toleration, from which even men who wished to be correctly informed would have difficulty in concluding that such occurrences are the worst of outrages against their fellow-countrymen in the Services; that they should be repressed as such by the Government, whose business is to protect its protectors. All the indirect evidence, in fact, from which engineers can infer how far labour is being used efficiently, tends to suggest that it is not, and they are thus concerned to inquire more anxiously for direct evidence, such as would be given by such measures as Mr. Morgan proposes; to ask if skilled men who might be used in the technical or other units of the Army are being kept, or allowed to continue, on work that less skilled men could do, and if men, skilled or unskilled, are doing work that could be done by women, if women were allowed to do it.

The proposal that standards should be instituted is not new. Apart from the few standards of dilution that the Ministry of Munitions instituted while Mr. Morgan was in its service, it was suggested elsewhere nearly a year ago that if by no other means uniform standards could be set up for economy of skilled and other labour, use of woman power, designs, methods of manufacture, and materials, even a new Government Department, charged with the single function of instituting and introducing such standards, might be a less evil than the continuance of the deadly anarchy which up to then was impeding efficient production. It seems hard that a remedy which is open to obvious objection should be necessary, when all that is really required is that existing departments, with their administrations ready made, should get together and agree, and that they should be supported by a firm and consistent Government policy. But whatever course is taken, Mr. Morgan's proposals must have immediate importance, because, on the one hand, they appear to be the only constructive suggestions in the field; and, on the other hand, their adoption would give an assurance that labour was being used with something like the utmost efficiency. In their details, doubtless, they may be open to revision. To adopt, for instance, the product of a production-efficiency and a dilution-efficiency as a figure of merit of works for war purposes, is to assume that the nation is equally short, on the one hand, of labour of all sorts, including women and men unfit for military service, and skilled men needed for use in industry, and, on the other hand, of skilled and other men of military fitness for use in the technical and other branches of the Army. It may well be that, for immediate war purposes, the country is shorter of one class than of the other; that, for example, it has more than enough skilled men for industry, if all the dilution were practised that is possible, but less than enough skilled and other men, if the Army is to have all the men it can use. If that were the case, a firm's true figure of merit for immediate purposes would not, as Mr. Morgan proposes, take as much account of its productive efficiency as it would of its dilution efficiency. Apart, again, from the bases on which standards were worked out, much of their practical utility would depend on the care with which data were obtained, and the uniformity with which results were applied. To be successful, in fact, Mr. Morgan's proposals would need the careful and sympathetic scrutiny of practical men in the industries and departments concerned, and a firm and consistent application of whatever principles of action might be agreed upon. But this is no more than is required by any practical reform; and, for the time being, no national need can be greater than that due and immediate attention should be given to these urgent, important, and practical suggestions.

It must not, however, be thought that the arrival of Peace will remove the need for standards. It will, indeed, remove some of the abnormal conditions of war work. Whatever may be the case for war purposes, it is unlikely, for instance, that in peace time efficiency of production can be of less consequence than efficiency of dilution, as for war purposes it well may be. But although the sanction by which efficiency will be demanded in peace times may be less terrible than what is now felt, it will be as irresistible, and may rapidly become even more evident. The hugely indebted nations will have been living for years at a rate of some ten times their normal expenditure, paying their way not by what they have been producing but by what, in the form of national loans, they will have been promising to produce. When Peace comes, those promises of production will begin to fall due for payment, and in this country at least, further earnings will be required to prevent the standard of life that the war has begun to establish for industrial workers from being impaired, or, indeed, to enable it to be raised still higher. The fulfilment of national promises, like the realisation of industrial hopes, will depend on production. At best it will be a hard task to bring production to the required level; it may be impossible if production is at less than its highest efficiency, or if less than the best possible use is made of all the labour that can be recruited. Standards of production, alike in methods, designs, and materials, and of utilisation of labour, both male and female, skilled and unskilled, are necessary now in order to save life; they will be no less needed after the war in order to earn a living. It will be full late to improvise them when the floodgates of international competition are opened again and wider than ever before. Engineers of all countries may, indeed, be seeking not so much what they may grab of markets already acquired by others, as what new markets may be created or satisfied. Between allied nations bounds not previously known may be set to competition, and industries may see that more is to be made by developing new markets than by squabbling for old. But understandings so enlightened and mutually advantageous will reinforce, and not supersede, the old doctrine of effective occupation. The condition on which a market will be left to producers in a given country will be that they hold it effectively; and for this the first condition will be efficient production.

Industry Must be Free.

The warning to which the chairman of the Mond Nickel Co., Ltd., gave expression at the annual meeting of that concern will be endorsed by large numbers of industrial authorities. Few besides those in actual command of our manufacturing works know what Government control has really meant during the past few years. The burden has been borne as cheerfully as possible as a measure of absolute necessity forced upon the nation by the exceptional circumstances of the situation. Unessential operations have had to be avoided, labour has had to be simultaneously pacified and placed under pseudo-control, raw materials have had to be diverted as varying demand for certain requirements has dictated, imports and exports have had to be directed for reasons which are obvious to all, though the manner of controlling departments has sometimes been less comprehensible. There is an accumulated experience of Governmental control which, while to some it may be an asset, will be to others an object lesson in what should be avoided in the future. The Prime Minister has notified his concurrence with the conviction of traders and manufacturers that control must be relaxed as speedily after the war as the national requirements will permit. Sir A. Stanley, the President of the Board of Trade, and Dr. Addison, the Minister of Reconstruction, hold the same view. The Mond Nickel Co., as we judge from Mr. R. Mond's statement, is one of the concerns that would have been enabled to make much more rapid progress during the last four years had not Government restriction confronted it with immense difficulties on every side. Hundreds of other industrial companies would, doubtless, say just the same thing. What is so necessary to-day, when sections of the community are agitating for continued "control," is that we should remember the lessons of this period of practical experience and recognise the great unwisdom that there will be in putting an unbearable yoke about the neck of industry in times when the situation throughout the world will call for the fullest possible freedom of enterprise. The bit and bridle are needful in controlling an unruly beast; but in the race for life upon which British industry will enter, a free rein will be essential. "When the boys come home," we shall have thousands of first-class men available who will want to enter with spirit and daring into rapid and thorough re-establishment of British industry and trade in all parts of the world. For their own sakes, for the sake of their families, for the sake of those who fought with them, they will want to do it, and if in order to pacify those possessed of Utopian dreams a halter is put about the neck of industry, the nation will be acting traitorously toward those who have fought for freedom. Mr. Mond observes, even to-day, when the war situation is clearing, a continued and increasing tendency on the part of Government authorities to interfere with the management of industrial concerns and to put restrictions upon a reasonable freedom of trade, and we believe that there are among our readers large numbers of careful observers who will fully agree with him that every attempt either by legislation or by regulation to perpetuate this Government control of industry should be carefully examined by traders and manufacturers, and any proposals brought forward with the object of retaining such control, *unless dictated by national necessity*, should be strongly opposed. "British trade had hitherto progressed, and held its own against all comers, without Government support or interference, and he was convinced that it would do so in the future." Earlier in his speech Mr. Mond had recognised that there were such things as "key" industries which were of vital importance, and we do not think that when he refers to the success of the past "without Government support" he was suggesting that such industries should again pass through experiences such as nearly brought about our ruin in the first days of the war. He is quite justified in demanding that if Government officials think control to be necessary, they must make out a clear and convincing case. They can do so with ease in the case of actual "key" industries—indeed, we believe that all political parties that count are entirely at one in the intention to safeguard the security of these. Reading between the lines, we judge that what Mr. Mond wants is freedom to get ready for the future by establishing plants and facilities, and we trust that the Government will not hold its restricting hand upon our industrial authorities in these matters a day longer than is vitally necessary. We do not want to revert to just that state of things that existed in 1914—surely nobody does—but we do want, as rapidly as ever we can, to restore and re-adjust our manufacturing facilities, and our labour and raw material positions. We trust that the thousands of Government officials, the high and lifted-up as well as the rank and file, will see this imperative necessity, and will facilitate the coming of the new conditions with every expedition, sacrificing patriotically in the interests of workers who earn their bread by the sweat of their brow and will want the assistance of accelerated industrial enterprise to give them the opportunity, any characteristic disposition to "hang on" to office.

When the thunder of ten thousand guns is silenced, and Peace enfolds the earth wherein lie those who gave their all to win her, a marching host of warriors will return with the spirit of victory coursing with their blood. Khaki no longer! Reunion, rest, and recreation for a while—but only for a while—and then? For some a little plain talk to those who stayed at home and should not. For others a thirst for enlarged opportunity—in fettered industries?—God forbid! The bonds must be torn away, and leave the limbs and muscles of the entire industrial body free for legitimate endeavour. Only the wise direction essential for the prevention of chaos can be permitted to remain.

The M.T.A. Meeting.

Despite the difficulties of the times, including the railway strike—which, fortunately, collapsed at the critical moment—there was a very good attendance at the "business meeting" of the Association last week, and the proceedings were both interesting and profitable. The chief deduction to be drawn from the discussion on Mr. Hatton's paper—and from the paper itself—is, we think, that municipal tramway engineers and managers, on the whole, have given a cordial and patriotic welcome to the national scheme of electric power supply, as embodied in the report of the Board of Trade Committee, though they are naturally desirous of examining the details of the Bill which is understood to be in course of preparation. A remarkable variety of what we may call side issues cropped up during the discussion, and there was a certain amount of opposition to the claim that a large economy of fuel could be effected, at any rate in particular localities, while the high cost of transmission and distribution over considerable distances was pointed out again; but the right note was struck by Mr. Stokes, of Bexley Heath, early in the discussion, and again by Mr. Furness, of Blackpool, towards the close, the former emphasising the fact that the utilisation of our fuel resources to the utmost possible advantage was the essence of the matter, and that all other considerations were of minor importance.

It is curious how the impression persists that the national scheme contemplates the wholesale scrapping of existing plant, with the consequent waste of capital; there is no ground for this supposition, and the time that has been spent at various meetings in condemning the imaginary orgy of scrapping has been wholly wasted. Only inefficient plant is to be put out of use, and what engineer would be prepared to advocate its retention in service? If the scheme is not to be carried out on common-sense lines, it were better to leave the thing alone. Elasticity is essential to success; every district possesses features peculiar to itself, and should be dealt with in the light of those local conditions—in some cases a huge all-embracing organisation may be desirable, in others a comparatively small concatenation of undertakings will attain the end desired.

The election of Mr. T. B. Goodyer to the office of President was a justly popular one, and in view of the work that has been accomplished by him in the interests of the tramway services, the distinction has been well earned. As a matter of fact, his reward will take the shape of an increased burden of labour, for his year of office will be a very busy one; but that he will cope with it successfully goes without saying, and we congratulate both Mr. Goodye and the Association on the appointment.

HE EFFICIENT UTILISATION OF LABOUR IN ENGINEERING WORKS.

The paper under the above title, recently read by Mr. Ben H. Morgan before the Institution of Mechanical Engineers, consisted in part of an historical summary of the means by which labour had been found during the war to meet the demands of the services. No one could discuss this aspect of the subject with more authority and insight; and it is not surprising that in the three separate meetings of the Institution in London, Birmingham, and Manchester at which the paper was read, the speakers were concerned more to compare notes of their experience of the work of women and discharged soldiers than to discuss the part of the paper in which constructive proposals were made for present and future working. Valuable as is a record of women's work in the war by one who has taken an eminent part in promoting and guiding it, the attention given at the Institution meetings to this aspect of the subject would have been better bestowed on discussing the measures suggested for assuring efficiency in the immediate and ultimate future. We comment on these proposals in another column; and for the convenience of readers who may not have appreciated them already we give here a short abstract of what they are.

Their primary object is to provide for the service of the war. As far back as June, 1915, it was recognised that all the skilled engineers in the country and the Services could not produce the munitions that were required, if they had to be made with the proportions of skilled labour that had been habitual. It was, indeed, questioned whether even at that time there was enough male labour for the purpose, skilled or unskilled; and when military service became a universal obligation, it was clear that no fit man of military age could be retained in industry honestly or safely if by any means he could be replaced on any work of national importance that he was doing. Accordingly, unskilled men had to be upgraded to eke out the insufficient supply of skilled men, and women had to be introduced to supplement and replace men.

These changes involved not only initial expense, but also, what engineers could spare even less easily, considerable trouble. The experience of firms who have faced the difficulties goes to show that, economically, the dilution of skill and of man-power has on the whole been beneficial; but probably most firms regarded it as in itself an evil, to be accepted only if it were unavoidable. Accordingly, the widest inequalities were found in the extent to which dilution was practised in works of the same trade, and even in the same town; and the worse diluted firms not only increased the needless use of skilled and other male labour, but also discouraged other firms from economising it where they might have done so if economy had been general. This state of things has continued to the present day, and, indeed, "as dilution has progressed since June, 1915, the disparity of effort has become more and more pronounced throughout the country." In certain classes of work, such as shells and guns, the Ministry of Munitions set up standards of dilution for the proportions of skilled, semi-skilled, unskilled, and women's labour that should be employed either in works making the products in question, or in the several groups of operations by which the products were made; and the fundamental suggestion of the paper is that some system of standards should be applied to all manufacture involved in the munitions programme, and might be invaluable as a permanent institution throughout the engineering trades.

The problem may be stated very simply. The nation has only a limited supply of skilled workers, and has an urgent need in the military services for all male workers, skilled or unskilled, who are not indispensably required for its munitions programme. Of the work to be done a part requires skilled and male labour; but in most shop practice more than that part has been done by skilled and other men. Accordingly, work so produced costs more in skilled labour and man-power than it would have cost if skilled and other men had done only what less skilled or unskilled men or women could not do. Many causes may contribute to this extravagance of skilled and other man-power. On the one hand, the work may not have been so subdivided as to separate the skilled part from the unskilled. The plant may not originally have been convenient for use by unskilled workers or women, or may not have been made suitable when, by proper additions or alterations, it might have been. The products of a works may have been too various to facilitate subdivided production. Even mere inefficiency of management or methods of manufacture may have had an exactly equivalent effect in promoting extravagance of skilled and other male labour, requiring more labour, and therefore presumably more skilled and other men, for producing a given article than would have been necessary under efficient methods. Such sources of extravagance may be grouped broadly as inefficient methods of production; and by the side of them is the more direct extravagance of using skilled or male labour on jobs which, in the circumstances of the works, could have been done by unskilled men or by women.

Through whatever cause the extravagance arises, the effect on the national skill and man-power budget is the same; and, in Mr. Morgan's view, each group of causes must be separately controlled. On the one hand, therefore, he proposes to set up standards for efficiency of production, measuring the number of labour-hours that should be allowed for each product; standards having the form of a figure of product per so many worker-hours, including a share of the management-hours. On the other hand, he would have standards of efficiency of dilution, being the ratio of the number of women and unskilled discharged soldiers to the total number of hands employed. The performance of each works would be compared with these standards. The ratio of their production efficiency, measured similarly in product per worker-hours, to the standard efficiency, would be their production efficiency; the ratio of their dilution to the dilution standard would be their dilution efficiency; and the product of these two coefficients would be a "figure of merit" for the works, which should determine its priority in allocation of contracts, labour, tools, and material. Where a firm was making a variety of products for which the standards were different, the figure of merit should be the arithmetical mean of its figures on each product. Both the standards and the figures of merit of the works would be reviewed periodically as fresh information became available.

To institute such standards, which should be applied to all possible contracts, close official estimates of the worker-hours involved would be necessary; and these would have the advantage of displacing the wasteful "time and line" basis. They might initially be based on the best practice attained in individual works, and, little by little, might be revised by introducing into the practice on which the estimate or standard was based methods practised in other shops, but as yet not in the shop that was best on the whole. Particulars both of the standards or estimates and of the methods of manufacture on which they were based should be communicated to each works. Their adoption would not be compulsory; but, as both orders and facilities for executing them would depend on the efficiency of the works in production and in dilution, the best methods and tools would be likely to be increasingly used.

Measures such as these should lead to standardisation of the best manufacturing methods, including output and sub-division of work; and to amplify the data on which they should be based, and facilitate their application to industry after the war, Mr. Morgan suggested that the Institution should set up a committee "to study and report on the best methods in each engineering industry of introducing women into works, the best way of training discharged soldiers, with special reference to methods and appliances for employing maimed men, the upgrading of workers, the best methods of training male and female labour, and cognate matters."

Japanese Exports of Electric Wire.—Electric wires to a value of £4,900 were exported from Japan during the five months ending May last, as compared with only £2,900 in the corresponding period of 1917.

AN ELECTRIC WORLD GIRDLE.

[COMMUNICATED.]

In the *Times Trade Supplement* for September is an article entitled "An Imperial Cable," contributed by Mr. Wm. Llewellyn Preece, M.I.C.E., M.I.E.E.

We first give particulars of the scheme suggested as explained in the article, reserving our comments and criticisms.

Mr. Preece says:—"The most economical system would be one long electric girdle round the globe, starting from Nova Scotia, touching at Cornwall, West Africa, South Africa, Mauritius or Rodriquez, West Australia, the East Coast of Australia, or Tasmania, New Zealand, Fiji, Fanning Island, and Vancouver."

"A separate cable would connect India with Mauritius, and a landline across Canada would complete the ring from Vancouver to Nova Scotia."

"The girdle would contain 27,000 miles of submarine cable and 3,000 miles of landline."

"There would be 12 stations, the principal being in Cornwall, South Africa, Australia, New Zealand, and Canada."

"Such a system could only be installed by the joint Governments."

"We may assume that each principal station would be connected up with the telegraph system of that country, and that this system would collect all messages and transmit them to the cable station."

"In addition, it would probably be desirable to call into existence a special Press Agency in each country, which would collect all news and transmit it to the cable station, and also receive all incoming news and distribute it to the newspapers."

"With such an arrangement the staff of this system would only be employed in the cable stations, and no other office would be required except the head office."

"Under these circumstances the capital outlay for a new ring should not exceed £7,000,000; but as there is no apparent reason why the Pacific cable should not form a section of the ring, the actual expenditure should not exceed £5,000,000, including two additional ships.

"The annual cost of working would be approximately—

Maintenance, renewals, and working of 12 stations and three ships	£300,000
Rent of landlines	10,000
Interest and sinking fund for paying off capital in 50 years	350,000
Renewal of cables, &c.	70,000
	£730,000
(say)	750,000

"This one continuous ring round the world would serve six stations, one in each country, and would, when worked duplex, be capable of transmitting at the rate of 100 words per minute—*i.e.*, 50 W.P.M. in both directions.

"If each country supplied all the other five with 10,000 words of Press news per day this traffic could be transmitted in 10 hours."

"*E.g.:* England could send out in 3½ hours 10,000 words round the ring to South Africa, India, Australia, New Zealand, and Canada; and, at the same time, Canada could send in the opposite direction 10,000 words to New Zealand, Australia, India, South Africa, and England in 3½ hours."

"South Africa and India would then have possession of the ring for 3½ hours; and after that Australia and New Zealand."

"Each country would thus supply all the other countries with 10,000 words of Press news, so that each country would receive 50,000 Press words within 10 hours—say, 11 hours to allow for corrections, delays, &c."

"Leaving another hour for daily testing, the remaining 12 hours could be used for private messages."

"During the transmission of Press news the cable directly connecting the two countries transmitting could be used at such times for private messages; therefore, England and Canada, South Africa, and India, Australia, and New Zealand could each transmit to the other during 3½ hours 10,000 words, or 60,000 words in all."

"During the 12 hours it would be quite possible to work as follows:—For two hours each country could transmit and receive from its adjacent countries—*i.e.*, Canada and England, England and South Africa, South Africa and India, India and Australia, Australia and New Zealand, and New Zealand and Canada could intercommunicate, and each country would be able to send 12,000 words in two hours—*i.e.*, 72,000 words in all."

"For the next 2 hours:—

England and India; India and New Zealand; New Zealand and England would intercommunicate; S. Africa, Australia and Canada acting as relay stations; and for the following 2 hours—

Canada and Africa; S. Africa and Australia; Australia and Canada would intercommunicate, and each could transmit 12,000 words, so that in these 4 hours another 72,000 words could be sent."

"Finally:—England and Australia; then Canada and India; then New Zealand and S. Africa could each intercommunicate for 2 hours, and as these two countries would be connected together by two routes, they could each transmit 12,000 words in the 2 hours, *i.e.*, 72,000 words in the 6 hours."

"The total private messages would therefore be—

60,000 + 72,000 + 72,000 + 72,000 = 276,000 words in all.

Allowing 25 per cent. for calls and corrections, the total number of paying words would be approximately 200,000."

"If a charge of ½d. per word were made to the Press Agency of each country, each would have to pay £104 per day—a revenue of about £220,000."

"As at least on the average 20 papers would take this supply in each country, each paper would pay only £5 per day for all this news."

"If a charge of 2d. per word were made for private messages, the daily income would be £1,600, or approximately £580,000 per annum. The total revenue would thus be £800,000, against the above-mentioned expenditure."

"If it were possible to transmit private and Government messages at a flat rate of 2d. or 3d. per word, the cable system would be filled with traffic throughout the 24 hours, and real union would be attained."

Even assuming that the cables are working regularly according to the time-table during the 24 hours, the revenue anticipated does not represent sufficient inducement to embark on such a speculative and risky investment.

Mr. Preece thinks it "well within the realms of possibility that the speed of signalling over the cables may be increased, thereby permitting a larger amount of traffic to flow, and the extra money thus earned would be almost entirely clear profit." He suggests the possibility of 10 per cent., or even a 50 per cent., increase. This may, perhaps, be realised for cable working in the *future*, but it is not usual to base present revenue estimates on merely future possibilities; and even so, it will be the same for all cable companies equally; and it is quite as likely that we may hear of as important an increase in speed through competing wireless systems.

If the advantages of this low-rate circular system were so much appreciated, it would soon become necessary to lay another to meet the congested traffic, and the circular cable would become a still more powerful competitor against already existing cable companies.

Mr. Preece says: "Such a system could only be installed by the joint Governments" of the British Empire League.

This fact would, of course, place the old companies under a great disadvantage, and bring pressure on them to reduce their tariff, and their doing so would tend to reduce the revenue of the circular venture.

That such a performance could be regularly kept up during the times mentioned through such a system working duplex at 50 W.P.M. each way, and with from one to four relays at intermediate stations, without frequent delays and serious reductions of the words on which the revenue is based, cannot reasonably be expected.

The number of hours allotted to each country for transmitting and receiving messages is the same, and if not conformed to would upset the time-table for other stations in the ring. If, therefore, the number of messages to be received from or sent to some of the stations are insufficient or too many for the time allotted, waste of time would result on this account.

Whenever communication on any section becomes interrupted for any cause, the elaborate time-table would again be upset, entailing reduction of traffic.

In the course of years the cable will develop mechanical and electrical weakness. To meet the contingency of a breakdown, and consequent stoppage of traffic through some of the sections, which may happen at any time, the laying of a second cable will be imperative, otherwise these Government stations would have to divert their messages through the lines of those old cable companies whose interests they had so little considered.

We are not told how long it will take to construct and lay the 27,000 miles of heavy-core cable, and as the financial harvest expected when it forms a girdle round the world, cannot be fully realised until the last section is completed, the interest on the capital will for that length of time be very small.

The principal reason given why the joint Governments should favour such a gigantic undertaking is, however, not that it would prove a great financial success, but in order to "transform the British Empire into a true league of independent nations, and consolidate the Commonwealth for foreign affairs and defence." This, it is said, "can only be definitely attained by much cheaper telegraphy—so reasonable in cost that their messages shall be rapidly transmitted and immediately answered, and all occasions of misunderstanding, as forced the States of America to break away from the Mother Country, and to become independent, avoided." "If it were possible to supply each country daily with ample

Press news from all the other countries at a cost of ½d. or 1d. per word, the principal newspapers would welcome the supply, and the people would read the news with interest." "Finally, if it were possible to transmit private and Government messages at a flat rate of 2d. or 3d. per word, the cable system would be filled with traffic throughout the 24 hours, and real union would be attained." "It is obvious that at such rates the whole Commonwealth would have a means of intercourse which would bind all together so closely that political means of consolidation would become a problem of secondary importance."

The advantages of increased intercommunication facilities, whether by cheaper and quicker means of travelling or telegraphy—and especially by cheap postage—are without doubt important, and likely to bind more closely widely separated nations speaking the same language and having so many interests in common; but that these interests would be so very greatly advanced by the extra means of communication provided by the circular cable in question, is very doubtful. Not only are the present conditions and facilities incomparable with those of nearly a century and-a-half ago, when telegraphy and cheap postage was unknown, but, with the alternative Atlantic cables to Canada and the comparatively cheap and high-speed land-lines across Canada, a much better guarantee of uninterrupted communication already exists as far as Vancouver. Thence to New Zealand we already have the Pacific Cable, which Mr. Preece thinks might be included in the suggested girdle.

Moreover, as the surface of the globe is traversed by alternative telegraph routes to all the countries of the British Empire—not to mention the continuously improving means of wireless telegraphy—the desirability of the joint Governments promoting such a tremendous and risky undertaking, in competition with existing cable systems, merely for the sake of another route, does not seem at all desirable.

Though not expressly so stated, it would appear as if this girdle is intended to serve as a strategic cable.

As in a great war our ships would be fully employed, the resources of even the British Navy would be unable to guarantee the safety of a cable encircling the globe; and, in fact, the strategic cable would be more likely to be intentionally broken by the enemy than any other.

A rupture in one or two places would dislocate the traffic and render the circular system unworkable.

Considering that a break or serious fault in very deep water often takes several months to repair—especially in the winter months—the annual revenue would be seriously reduced. This is a contingency which must be taken into account when considering the risks to revenue entailed by putting so many eggs into one basket.

For a submarine cable system of 27,000 miles instead of providing only three steamers in the estimate of cost, a small fleet would be necessary, so that one repairing ship may be stationed within a reasonable distance of its field of operations, unless it is contemplated—as when it becomes necessary to divert messages—to draw upon the kind offices of competing companies by asking them to lend their repairing steamers to meet the emergency.

As the core to give 50 W.P.M. each way through such abnormally long cables must be very heavy, it will not be a light type of cable easy to raise from great depths, and the cable tanks must be large, too, and the ships able to carry long lengths; consequently, small repairing ships would often not be serviceable even if available.

In the case of a breakdown is the large traffic, which it is expected will keep the circular cable busy during the 24 hours, to be suddenly diverted through the lines of competing companies—already doing a heavy traffic—who, owing to the serious competition, had been forced to lower their tariff per word? That this enforced lowering of tariff must react on the circular cable and reduce its annual revenue must also be taken into account.

If the 10,000 words daily of Press news is to be so greatly appreciated by the 20 papers in each country, would not competing telegraph companies find it advantageous to upset this monopoly?

Under present conditions very important news and stock quotations find their way, by telegraph, to most of the Dominion papers, so it may be questioned if the 10,000 extra words of Press news through the circular cable would be worth £5 daily to each of the 20 papers.

It is, moreover, even more doubtful if 10,000 extra words of Press news would make such an increase in the reciprocal good feeling of kindred and already closely allied nations as to call for the laying by their Governments of such an extravagant circular cable. If any such marked increase in mutual appreciation can be effected, it will surely be more realised through the medium of cheap postage and fast steamers bringing our kinsmen into closer personal intimacy than by short telegraphic messages, most of which would be restricted to Government and mercantile business; but if it be considered so important to increase the Press news, could not this be more equitably and cheaply done by inducing existing companies to send certain Press news at the low rate per word suggested, and indemnifying the said companies against loss for any difference below the usual tariff?

The precise meaning of "transforming the British Empire into a true league of independent nations" is not clear. If this league is intended to be a substitute for the League of Nations advocated by the Entente Powers as the guardians of the peace of the world against renewed aggression of the Central Powers, and guarantors of the freedom and independence of the smaller States, it is undesirable; because the larger the number of nations comprising that League the more powerful and effective will be their control. Instead, therefore, of the British Empire being exclusive, it should rather include all nations, small and large, willing to co-operate in upholding international law, liberty and equal rights. A League of only English-speaking nations, moreover, seems quite unnecessary, because their loyalty has already been put to the proof, and they have shown the world that in the cause of freedom and humanity they require no specially binding covenant, as they can be trusted never to fail to champion these sacred causes for their own sakes.

THE MUNICIPAL TRAMWAYS ASSOCIATION (INCORPORATED).

Annual Conference at Leicester.

(*Concluded from page* 310.)

The Conference, which was duly held at Leicester Town Hall last week, was favoured with fair weather, on the whole, and a very good attendance was recorded, the Council Chamber being filled to its utmost capacity. The Mayor of Leicester having greeted the visitors, Alderman Flint delivered his presidential address, and this was followed by Mr. Hatton's paper, of which an abstract appeared in our last issue. The discussion on this paper, which occupied the remainder of the morning session, is reported below.

At mid-day the Mayor (Alderman North, J.P.) entertained the members of the Conference at lunch in the Museum Buildings. The Mayor regretted the obviously unavoidable absence of the President of the Board of Trade, Sir Albert H. Stanley, but welcomed a representative of the Board in the person of Mr. J. Devonshire, chairman of the Board of Trade (Tramways) Committee, remarking that it was always advisable to keep on good terms with those holding the whip hand; he deprecated an excess of centralised control, but recognised that in moderation it was beneficial.

Replying to the toast, Mr. Devonshire referred to the rationing of coal, and the impression that tramway undertakings had been singled out for rationing; he said the Committee had acted under instructions, and assured the members that whilst they had been asked to economise because they were organised, the fact that they were organised ensured that they would not be starved for coal, in view of their importance in the national service.

Councillor Mayne proposed the "Town and Trade of Leicester" in a humorous speech, to which the Town Clerk, Mr. H. A. Pritchard, responded; and Alderman J. R. Freears, J.P., Deputy Mayor, proposed the "Municipal Tramways Association," the toast being briefly acknowledged

by the president, Alderman S. Flint, J.P. Proposing a vote of thanks to the Mayor, Councillor Timpson remarked that Alderman North had occupied the chair for four years, and had been instrumental in raising £100,000 for wounded soldiers.

On the resumption of the business meeting in the afternoon, the report of the Executive Council on the formation of a National Joint Council for the tramway industry was considered, and a statement as to the objects of the proposed Council, and as to the negotiations which had taken place with regard to its formation, was made by Mr. McElroy. The feeling of the meeting was generally favourable to the proposal.

On Friday morning, after meetings of the Executive Council and the Managers' Section, the business meeting was resumed at 11 o'clock. The report of the Executive Council and the treasurer's statement were received and adopted, and the officers for the ensuing year were elected. The names of the new officers and members of Committee are as follows:—

President.—Mr. T. B. Goodyer (Croydon).

Vice-President. — Alderman Sir John W. Courtis (Cardiff).

Hon. Secretary.—Mr. W. Clough (Bury).

Ordinary Members of Committee.—Clr. J. Timpson (Portsmouth), Messrs. A. L. C. Fell (L.C.C.), J. B. Hamilton (Leeds), G. W. Holford (Salford), and R. L. Horsfield (Walsall).

Mr. C. J. Spencer (Bradford), hon. secretary 1911-1918, retired on account of his accepting an important post under Government, and an interesting feature of the sitting was the presentation to him of a valuable gold watch, together with a handsomely appointed dressing-case for Mrs. Spencer, which had been subscribed for by the members. Speeches were made by Mr. Hamilton (chairman of Executive Council), the President, the Chairman and Vice-Chairman of the Bradford Tramway Committee, and others, expressing the heartfelt admiration, esteem, and real affection of the Association for Mr. Spencer, and the highest appreciation of his valuable services. In the course of his reply Mr. Spencer said that he had been a member of the Association from its inception; the post he was vacating involved a great deal of hard work, but it was pleasant work, and well worth while; he thanked the Corporation of Bradford for the assistance of the clerical staff and office accommodation. The Conference then unanimously elected him an honorary member, the highest honour within its power, which is shared by only one other member.

The proceedings closed with votes of thanks to the officers and to the Corporation of Leicester, and the members were afterwards entertained at lunch by the retiring President, Alderman Flint, Chairman of the Tramways Committee, in the Museum Buildings.

During the Conference visits were paid by parties of the members to various engineering features of interest in Leicester and the neighbourhood. The Conference, as a whole, was considered a highly successful event.

The Post-War Position of Electric Power Supply.

The discussion on Mr. Ernest Hatton's paper (of which an abstract appeared in our last issue) was opened by Mr. J. M. McElroy (Manchester), who remarked that the question of electric power supply was engaging the attention of several other associations, especially the Incorporated Municipal Electrical Association, and proposals relating thereto were under the consideration of the Government. The importance of the subject to tramway authorities was due to the fact that at least 25 per cent. of the total output of electrical energy was used by tramway undertakings, of which there were 176—93 municipal, and 83 company undertakings. These consumed 620 million units per annum, of which 79 per cent. was taken by municipal undertakings. Of the 176 tramways, 38 had their own power stations, and 138 purchased energy; but 50 per cent. of the energy used was generated by the former in their own stations. If, however, the London County Council system were excluded, only 39 per cent. was generated in tramway power stations. The question whether energy should be generated or purchased had been much debated in bygone days, but the position was now quite different. Experience showed that in certain towns the tramway authorities had been overcharged in comparison with industrial concerns, having in view their good load factor. In 1911 the two Associations—the I.M.E.A. and the M.T.A.I.—prepared a joint scheme, settling the principles on which the charges for energy from combined stations should be based. He had recently inquired of all the municipalities concerned, with the result that he found that practically none of them had adopted the scheme; it would be interesting to know why. Mr. Hatton asked why the tramways should not help the power side of an undertaking. There was a suspicion that in order to develop the power side, exceedingly low prices had been charged for motive power, which could not have been done without the tramway load; cheapening power at the expense of the tramway users was unjustifiable. He (Mr. McElroy) advocated the development of electric power supply on lines that would help all industries, including tramways. The main conclusions of the Coal Conservation Sub-Committee's report were worthy of serious consideration; they included the appointment of a board of commissioners to develop electric power supply over the whole country, and to stop the extension of uneconomical stations, the delegation of control to new district authorities, and the standardisation of system. In a prefatory note the Minister of Reconstruction referred to the relations between company and municipal undertakings, and stated that the whole matter would be thoroughly investigated before any action was taken by the Government. The Board of Trade Committee had also issued a valuable report; it recommended the formation of a new body of Electrical Commissioners, to have general control in the United Kingdom, the abolition of the existing system of small areas, the division of the country into suitable areas presided over by District Boards which would be responsible for generation, while the existing undertakings might retain the distribution, and the financing of the scheme with Government assistance. After further quotations from the report, he expressed the view that the setting up of a national authority and of district boards controlling wide areas was based on sound principles, but the details must be carefully examined when it was seen what steps Parliament proposed to take. Something ought to be done quickly to direct future development on right lines; the continuance of present conditions would be fatal to success in competition, and a cheap supply of power was essential to the national welfare.

Mr. H. Webber (Keighley) agreed with Mr. Hatton that the reports were too rosy in anticipating great results in the near future. All undertakings had suffered from heavy standing charges owing to rapid changes in the methods of generating electrical energy, and the new scheme would likewise be burdened with heavy capital outlay for new plant, compensation to municipalities, long mains, &c. Transmission losses would be nearly as costly as the transport of coal by rail. The North-East Coast companies had been developing on lines similar to those proposed, but were not supplying much cheaper than in Keighley, where before the war energy for power was supplied at less than ½d. a unit. No great economy in steam consumption was to be gained by increasing the size of station above 30,000 kw., and a 6,000-kw. set was nearly as economical as one of 15,000 kw., though the latter showed a saving in labour. Breakdowns in large stations would be more serious, and reduplication of feeders essential. He believed the scheme would eventually develop into a working system, but it should not be rushed.

Mr. H. P. Stokes (Bexley Heath) feared that the discussion might drift into narrow lines, and urged that the matter should be considered from the national point of view. Conservation of coal was the main question—engineers were apt to look at it from the standpoint of use. Coal was our most valuable national asset, and should be used in the most economical way possible; generating steam was *not* the best way of utilising it. If it were used to the best advantage, electricity would be a by-product; it possessed enormous resources, more important than the mere generation of power. The Association ought to support the formation of a committee to develop the use of coal on the most advantageous lines. They were too apt nowadays to standardise everything: electrical energy could not be limited to one particular form—each form possessed peculiar advantages for certain processes; standards might be fixed for railways and lighting, and for certain industrial processes, but to establish one standard for all purposes was a mistake.

Mr. W. Murray (Walthamstow) said he understood that from the engineering standpoint the scheme was a good one, but from a financial point of view he thought it was open to criticism. Everything depended on what was done with the existing generating stations; if they were scrapped, the new scheme would be handicapped with an immense burden of debt. There was also a danger of losing in distribution the saving in generation—long mains were very costly. If a loss was made, who would bear it? During the first few years a loss was possible, and even probable. Apparently municipalities must part with their tramway or supply stations, whereas private companies could carry on. The appointment of the Commissioners was in the hands of the Board of Trade, but, in view of past appointments, the Board ought to be subject to some supervision. The District Boards were to be small bodies—larger numbers would give greater safety from their capture by cliques. Compensation for displaced officials ought to be compulsory, not optional.

Mr. R. H. Wilkinson (Huddersfield), congratulating Mr. Hatton on his paper, said that if, when starting the tramway undertaking, Huddersfield had purchased energy, it would have cost 3d. a unit, and the growth of the system would have been restricted; having its own power station, supplying

energy at ¾d. a unit, the system had developed to a length of 56 miles of track, and a revenue of £170,000.

Mr. E. S. Rayner (Doncaster) thought that Mr. Hatton's opinions had been modified since he drew up his report to the Newcastle Corporation. He contended that no station ought to be taken over without a guarantee that the supply of energy would be cheapened. He doubted whether Government control tended to economy, citing the telephone service as a case in point, and questioned the advisability of handing over the whole power of control to a board. Capital charges had a great effect on the supply price, but not on the generating cost, and if the capital were watered the scheme would be of little use. With regard to the question of charging uniform prices everywhere, he pointed out that the location of important industries, such as the manufacture of iron and steel, cotton, shipbuilding, &c., was not determined by the availability of a supply of power.

Mr. C. L. E. Stewart (Rawtenstall) held that the Coal Conservation Report had been discredited; the Board of Trade Committee's report was more worthy of consideration. Certain stations of moderate dimensions could beat the big ones in point of economy, and the big station had not proved its case. Both reports dealt with units generated, whereas the real issue was units sold; at Rawtenstall the works cost was 0.4d. per unit, but they had to get an average price of 0.9d. per unit sold. The loss in distribution might amount to 20 per cent. He drew attention to the statements of Mr. Fedden and Mr. Pearce at Manchester with regard to the cost of transmission of electrical energy. Referring to Mr. Murray's remarks, it was not intended to scrap old stations or to build superstations at once, but to develop the scheme by degrees in suitable areas, weeding out inefficient stations. The Government scheme would do away with the spirit of emulation at present existing between neighbouring undertakings. Frequency and phase should be standardised, but the voltage should be left open.

Mr. C. Furness (Blackpool) said that the discussion was degenerating, and that the report of the Board of Trade Committee had been depreciated; he felt it his duty to support the report in the national interest. There was no intention of scrapping economical plant. They had been marking time since August, 1914, with regard to extensions; many towns were waiting to spend capital in development when they were permitted to do so—in the neighbourhood of Blackpool he knew of an aggregate contemplated expenditure of £300,000. The real question was whether each should go his own way, or whether they should have a joint board, and lay out capital on the most economical lines. He did not commend the action of the Council in asking Mr. Hatton to read a paper on this subject—there were matters of far greater importance to tramway men which should have been discussed that morning. He thought that Mr. McElroy had over-rated the importance of the traction supply. At Manchester the cost of energy for traction was 13 per cent. of the revenue; at Newcastle it was only 7 per cent., at Blackpool 12½ per cent., at Cardiff 5 per cent., at Burnley 20 per cent. The cost was not a factor of great moment, and he, personally, did not believe in the fetish of low costs—a reasonable profit was justified.

Replying on the discussion, Mr. Hatton remarked that at Keighley Mr. Webber was practically supplying a huge factory, so that the cost of cables was comparatively small. The experience of the Newcastle companies showed that the risk of breakdown was not serious. With regard to Mr. Stokes's remarks, the utilisation of coal was under investigation by the Government. He agreed with Mr. Wilkinson regarding the advantage of having one's own power station. Mr. Rayner suggested that he had changed his mind, but it should be remembered that he reported on the Coal Conservation Report, and that the Board of Trade Report had not then been published. Let them all join together, if it were necessary in the national interest—but under Government control, not that of a company. Referring to Mr. Stewart's remarks, he said that the supply of power to railways was a matter of vital importance; and he reminded Mr. Furness that tramway men were keenly interested in the constitution of the District Boards.

THE BRITISH MAGNETO INDUSTRY.

Three months ago we formed one of a party of journalists representing the technical Press of the country which was invited by the British Ignition Apparatus Association to visit the various works in the Midlands, to see what had been accomplished in the cutting of German associations by British enterprise in the manufacture of magnetos for ignition purposes.*

Last Friday, with a similar aim in view, we were privileged to make a tour of inspection of the works of the British Lighting and Ignition Co., Ltd. (proprietors, Messrs. Vickers, Ltd.) The manufacture of magnetos affords as striking an example as any of the extent to which a key industry—for such it is now recognised to be—was allowed to fall into the hands of the foreigner. The enterprise and perseverance, under many discouragements and initial obstacles, of the British firms who have taken up the manufacture of magnetos, have completely reversed this unsatisfactory condition of affairs. British magnetos are to-day being produced which are demonstrably superior to the foreign article and these machines are standing greater strain and stress than was ever thought of before the war.

There is every possibility that the work will have a measure of protection against outside competition when peace comes, and the pioneer work of the manufacturers should have its reward. It is not a bad start, after all, to have effectually dissipated the fabled superiority of Stüttgart. A visit to some of the factories now engaged in the production of magnetos should convince anybody that this is purely a fallacy.

The B.L.I.C. works are housed in a five-storey building with a basement utilised as a general stores. The lighting of the works is excellent, and in only one or two cases did we note that artificial light had to be used. The factory is fitted out with up-to-date machinery which is well arranged, the whole works being electrically driven, both the individual and collective drive being utilised. We were greatly interested in a number of ingenious machine tools and jigs that we saw at work in the factory, and the moulding of insulating material is carried out very efficiently. We were informed that the Bosch Company spent a large sum annually on cutting tools for turning moulded insulating material and parts, as the high-speed steel tools used were only capable of turning a small number of parts. The B.L.I.C. firm employs diamond cutting tools for turning all moulded insulation parts, including brass contact pieces, &c. These tools are very efficient, and we were informed that they had a very long life.

Another feature that we noted with pleasure was that the firm employs the metric system of weights and measures. We were informed that the firm had to use the system in certain instances, and it has been adopted throughout the magneto factory, with a resulting saving of much time and labour.

Extreme care is taken in machining, and the working limits employed are very fine, every part being manufactured to limit gauges. So intricate are certain parts of the magneto that in many instances special machine tools have been evolved. After each separate operation, the parts are examined carefully in a well-organised view room.

Special care is given to the armature and condenser; the fineness of the wire and the extreme delicacy of the mica demand particularly deft skill in handling.

In the main test rooms all material is examined and carefully tested—magnets for strength and performance, insulating materials for breakdown voltage, and the metals used in the mechanical parts for strength and hardness. The finished magnetos undergo most exhaustive tests; every machine is submitted to a prolonged endurance test at high speeds and at a voltage much greater than that required for actual service. Every machine is tested to see that the sparking at high speed is regular, special devices being employed to detect instantly any variation under high speed conditions.

An important feature, appealing to motorists, is the capacity of the magnetos for sparking at low speed, thus giving easy starting. They are designed specially with this end in view, and new features are rapidly being incorporated to improve them still further in this respect.

Special attention is being devoted to experimental and research work, both in regard to electrical performance and manufacturing processes. Important results have already been obtained, which are being embodied in the newer designs, with the result that smaller, lighter, and more efficient magnetos are now being produced.

* Elec. Rev., June 21st, 1918.

ANOTHER 35,000-KW. TURBINE WRECKED.

On August 1st a 35,000-kw., 20-stage, 1,500-r.p.m., single-cylinder impulse turbine in the Northwest Station of the Commonwealth Edison Co., Chicago, Ill., was completely wrecked. The main generator and possibly some of the wheels were the only parts not seriously damaged. There were no fatalities and no casualties. The turbine had been in service since December, 1917, and was of the latest design of the General Electric Co., U.S.A. Naturally, one of the first thoughts of engineers on learning that the machine was wrecked was: Is this accident a parallel with the accident to the turbine of the same type and capacity wrecked in the O Street station of the Elevated Railways Co., Boston, Mass., on February 14th of this year?* It is not identical, though the trouble was in the low-pressure end, as at Boston.

According to *Power*, September 3rd, the Chicago machine carried no load at the time it went to pieces, but had been in service all day. It was taken off the line shortly after midnight, July 31st, preparatory to cleaning the condenser, and, as is the usual good practice, the crew immediately arranged to give the machine its regular monthly overspeed run to test the automatic stop governor.

* Elec. Rev., April 5th and 12th, 1918.

The overspeed test is given by the operator, who pulls up on the governor lever. This was being done when the accident occurred. The generator is of 25 cycles. The switchboard operator states that the speed at which the turbine began to be demolished was that which gave but 26½ cycles, or less than the customary 10 per cent. allowed before the automatic overspeed stop governor functions. The speed corresponding to 26½ cycles is about 6 per cent. above the normal speed of 1,500 R.P.M., or 1,590 R.P.M. When the overspeed test was made on June 1st the speed reached 28 cycles, or 12 per cent. above normal. The operator tripped the throttle by hand when he saw that the automatic stop did not function at 27½ cycles. On the July 1st overspeed test the automatic stop governor tripped the throttle at 27½ cycles.

At the time of the wreck the conditions were ideal for observation of the behaviour of the machine, for correct reading of the tachometer by the men at the turbine and of the frequency meter by the switchboard operator. There was no emergency, there were no unusual conditions. The builders understand that the voltmeter pointer was hard over against the extreme stop, and are attempting to determine at what speed the generator would have to run to create such voltage.

At the time of the wreck the steam pressure was 240 lb. There is comparatively little load on the station at this hour of the morning. The throttle was wide open. The watch engineer was standing at the throttle while the overspeed test was being made. Nothing unusual was happening. Suddenly there came a thump, severe vibration, and a crash as the low-pressure casing burst and pieces of metal and blades flew about the room. The man at the throttle tripped it when he saw the low-pressure casing burst.

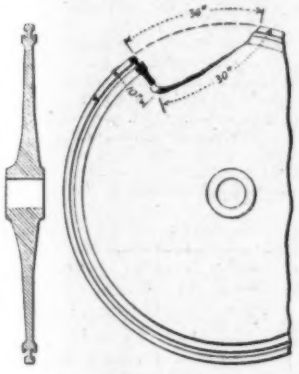


Fig. 1.—Showing Piece cut out of the Nineteenth Wheel.

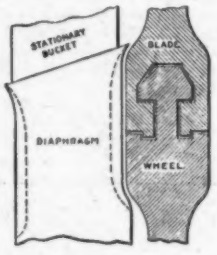


Fig. 2.—Dotted Line shows how Diaphragms were Cut Away.

The significant facts relative to the damage to the turbine are these: The cast-iron low-pressure casing was blown away, from the eighteenth wheel onwards. The high-pressure casing, made of cast steel, was cracked, chiefly below the reinforcing webs. The diaphragms in the last low-pressure stages were broken up; the semisteel cone supporting these diaphragms was demolished. The governor was knocked away completely from the turbine. Housings for the three bearings for the turbine, that is, that at the governor end, and the two between the turbine and generator, were all broken.

The bedplate beneath the outboard-bearing pedestal was cracked. The housing at the bearing on the high-pressure end was torn away where its flanged bottom was bolted to the bedplate. The flanged bottom of the bearing housing was tilted up in the direction of rotation of the shaft.

The next to the last low-pressure wheel of the Chicago machine, or the nineteenth wheel, had a piece 36×30×12 in. broken out of it as shown in fig. 1. The breaking of this wheel is the most significant feature of this accident.

The top or the periphery of the last (twentieth) low-pressure wheel particularly was bent so that it presented a wavy line. About one-quarter of the number of blades on this wheel were torn away and the remainder were badly bent. Some blades remained on all the wheels that were visible. The turbine at the time of writing had not been opened up, therefore the condition of the high-pressure end of the rotor was not known.

The shrouding on the last low-pressure wheel is, of course, gone. Incidentally, it is enlightening to know that some weeks ago the shrouding on the third from the last low-pressure wheel, or the seventeenth, got loose from the blades. The blades were cut down and new shrouding was put on.

Pieces of diaphragms and pieces of the great cone supporting the low-pressure diaphragms fell into the condenser, crushing the tubes for several rows from the top row. The support for the bearing at the exhaust end of the turbine was not fractured, but the bolts holding it were loosened. All the nozzles in the twentieth diaphragm were knocked away, and the ring holding the tops of the nozzles was broken.

The violent vibration and backlash of its gears possibly shook the governor completely from its position. It is reasonable to presume that it was not knocked away by being hit by a piece of metal. It was farthest from the low-pressure end where such pieces started on their flight, and in a direction at right angles to that taken by the flying pieces. However, one will recollect that at Boston four large pieces of metal went through the end wall of the turbine room near the roof. This is in a direction at right angles to lines drawn radially from the turbine rotor, or from the direction that most of the flying pieces of metal took.

The breaking of the bedplate near the pedestal for the outboard bearing excites inquiry. There are two bearings between the low-pressure casing and the main generator, one on each side of the flexible coupling. When the housings for these bearings broke, the shaft was not held rigidly except at its extreme ends. The generator rotor, weighing many tons, revolving at least at 1,500 R.P.M., would naturally tend to spring the shaft and cause it to whip, and this would be likely to put stress on the bedplate sufficient to fracture it. This assumption invites credence because the bedplate where it was cracked was raised from its normal position.

To return to the broken nineteenth wheel, the most significant feature of the wreck, the piece broken out was of the shape and relative size shown in fig. 1, and weighed about 200 lb. A natural inference is that this was the first part of the rotor to let go, and so precipitated the wreck. A portion of the piece was taken to the builders' shops at Schenectady for examination, and they say the metal shows no defects.

The wheels are of forged steel, tensile strength 130,000 lb., elastic limit 73,000 lb. The nineteenth wheel is about 8 ft. in diameter and is shaped as shown in section in fig. 1. Ordinarily the temperature of these wheels when the machine was in service was that corresponding to the vacuum in which they revolved. When running without load, however, the temperature might have varied from about 95 deg. F. to 200 and 300 deg. F. Our contemporary does not question the accuracy of the designer's calculations relative to these wheels, but remembers that when this design of turbine was first brought forth, the Massachusetts Institute of Technology was engaged to check the stresses in the wheel, that in this particular wheel (one from the Boston turbine), the factor of safety was found to be four, and the professors did express it as their opinion that because of the shape of the wheel fracture might develop if it was subjected to sudden extreme temperature changes.

It is possible that the wheels of the Chicago machine were subjected to temperature changes at the time of the wreck, as the machine had been carrying its usual load, and it was only two or three minutes from the time the load was taken off until the damage was done.

Besides the symptoms audible immediately previous to the turbine letting go—there was no undue vibration, one violent thump being the first indication of trouble—there is other evidence that the wheel was the first part to break; and incidentally this evidence seems to show that the blades on the last two wheels did not let go first, and by centrifugal force alone, as was current rumour in the days immediately after the accident. An explanation, given in the following, is necessary here:—

Reference to fig. 2 shows how these last low-pressure blades were mounted on the wheel. The clearance between the diaphragm and the wheel was ordinarily ¼ in.; but in the Chicago machine the diaphragms were cut away as shown by the dotted line, to give sufficient clearance to allow for two possibilities, namely, distortion of the diaphragm, and failure of the wheel to preserve rigidity at its rim. The peripheral speed was about 1,000 ft. per sec. for these last wheels. Therefore should rubbing of the diaphragm against the wheel occur, the base of the blades would be burned away at the fastenings. There was no evidence of such rubbing in the Chicago machine. Many of the blades had the appearance of having been struck a heavy blow, and it is likely that this blow, together with the centrifugal force, tore them from their fastenings. The blades appeared to have been wrenched away from the wheel. At the time of writing no examination of the thrust bearing had been made. The adjustment to the thrust bearing, as it was indicated by the indicator for the purpose, revealed no change in the position of the bearing.

After the Boston accident, all turbines of this type had their secondary valves locked by the builders, thus lightening their load. The Chicago machine had its load limited to 28,000 KW. maximum.

WAR ITEMS.

Conditions in Germany.—The "Times" correspondent at the Hague, referring to the condition of affairs in Germany, mentions that some thousands of Dutch workers engaged in various industries remain at Duisberg, and they are being fed by their employers. Accidents are constantly happening owing to the machinery being worn out. "Last week in the Rheinisch-Stahlwerke a mechanical saw was destroyed owing to electrical contact, four Dutch workmen being killed."

Exemption Applications.—Chelmsford Tribunal has dismissed an appeal by E. Hockley (46), electrical engineer, as

he holds a voucher issued by the War Agricultural Committee, with the right to re-appeal.

At Exeter, the National Service Representative applied for a review of the case of J. Lake (33, Grade 1, late C 2), electrical engineer at the Corporation electricity works. The city electrical engineer wrote that the man had charge of the electrical power motors in the city, and it was important that they should be maintained. He had charge of about a third of the motors in the city which were supplied with energy from the Corporation works. The exemption was confirmed.

At Torquay, three months were conceded to J. F. Veale (48, Grade 2), electrician.

At St. Albans, exemption was refused to F. Sandford (32, Grade 3), electrical engineer, of Childwick Green.

Canterbury Tribunal has granted another four months' exemption to A. Johnson (26, Grade 2), in charge of the electrical installation and motors of Messrs. Court Bros.

On the recommendation of the Advisory Committee, the Rochdale Tribunal has granted exemption until December 31st to B. R. Eves (37, Grade 3), tram conductor and motorman, engaged with the Corporation.

At Taunton, on a review, exemption held by T. H. Horrill (38, C 2), engine driver and stoker; W. H. Trott (38, B 2), engine driver and stoker; S. G. Coles (25, B 2), cable jointer, &c., and G. W. Lee (19, Grade 3), electrical engineer, engaged in the Corporation electricity department, were withdrawn, the men now holding protection certificates.

Before the Sevenoaks Rural Tribunal, an appeal was made by the Electric Light Co. for exemption, without the volunteer condition, for W. Ellis (25, Grade 3), electrical engineer. The managing director (Mr. Reeves) said that Ellis was the only skilled man left, and his working hours would not allow him to carry out the volunteer duties. He produced a letter from the Board of Trade to the effect that Ellis was necessary for the proper carrying out of the undertaking. He regularly worked 12 hours per day, and frequently had to take on another shift. Colonel Sladen said that the company must get another man to help. After Ellis had made himself proficient in drill and shooting he might be released from the volunteers. The assistant manager said that they had tried to get men, but they could not unless they offered to double the wages, and this no company could stand. Col. Sladen: It is not a question of companies making money, it is a question of the defence of the Empire. The volunteer condition was imposed, and Mr. Reeves said he should appeal to the County Appeal Court on the ground that the man's time was fully occupied.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Greatest Industrial Problem.

I always look to your leader on war problems with considerable interest, and the article on "Industrial Problems" of the 20th inst. is certainly no exception. One direction in which I have been seeking for a means by which after-the-war difficulties may be reduced is the immediate development of a scheme of national education of the wage-earners in regard to economics of wages in relation to production on the one hand and supplies on the other. It appears to me that the Industrial Reconstruction Council might do a distinctly useful work by the issue of well considered posters illustrating pictorially how a "£5 per week" standard of wages for one trade, with other producers securing corresponding rates, may prove very unremunerative in practice when it reduces the possibility of the potential employers of such highly-paid men securing enough orders to keep their works going. For example, we need to bring home to the bootmaker that if the community doubles his wages in order that he may buy bread, the baker's wages must be correspondingly increased so that he may buy boots; and that while that process may work fairly well when all the boots that he can make can be sold at a suitable price either at home or abroad, it may leave him without wages at all if bootmakers of other nations can supply as good boots* for less money. In such event even "protection" would not enable us to pay with boots for the foreign corn that we need.

While it can be neither expected nor desired that wages will revert to pre-war rates, it does appear to be important that every possible step be taken to secure that the wage-earners may be convinced that a good standard of living can better be ensured upon the basis of a lower rate of wages than rules at present, than can be ensured upon continuance of the existing rates, and this valuable education of the general public would probably be materially furthered by well-conceived pictorial advertising propaganda. The need for a colossal readjustment of the popular view is illustrated by the general recognition that a baker or greengrocer who raises his charges is a "profiteer" who is fair game for the weak jokes and extortionate fines of any Court, while the child of 17, who gets 40s. a week for typewriting to help the War is a "patriot"—like her father, who used to wash cabs, but is now a munition worker drawing £6 a week from a grateful country! And the "people love to have it so."

G.P.O., *September 27th*, 1918. A. J. Stubbs.

The Householder and the Coal Rationing Order.

Owing to my absence from town, and to the unavoidable delay caused by the recent deplorable railway strike, the corrected proof of my notes upon "The Householder and Clause 7 of the Coal Rationing Order" did not reach you in time to enable you to insert some necessary corrections. Moreover, owing to an oversight, two tables intended to be separate were printed as one, which will cause some confusion of thought in the mind of the reader. Further, in estimating the *actual* draft upon our fuel resources, I decided that the heat value of the gas obtained in producing coke, and of the net coke residue in the production of gas, should be dealt with in more detail.

The "Summarised Results" published in your issue of to-day, should, therefore, be set forth as under. The expression "effective" heat means the percentage of the total heat of combustion of the quantities mentioned in Clause 7 of the Order, which may be assumed on the average, to appear as sensible heating effect.

The meaning of the expression "effective coal equivalent" is best explained by an example, thus:—The net weight of coke produced per ton of coal distilled in the manufacture of gas is about half a ton (1,500 lb., less 375 lb. used for heating the retorts). It is assumed that 1·125 tons of coke is needed for the production of 4,500,000 "effective" therms. In the production of 1·125 tons of coke available for sale, there will therefore be distilled 2·25 tons of coal, and the production of 1·125 tons of coke will, therefore, result in the concomitant production of about 22,500 cb. ft. of gas, of which about 21,000 cb. ft. will be registered by the consumer's meter. The "effective" heating value of 15,000 cb. ft. consumed by the householder is taken to be 3,400,000 therms. Therefore, the "effective coal equivalent" of 21,000 cb. ft. is $\frac{21,000}{15,000} \times \frac{3,400,000}{4,500,000}$, or nearly 1·06 lb. of coal. Hence the *net* draft on the fuel resources of the country, when the householder obtains 4,500,000 therms "effective" heat from the consumption of coke, is 2·25 less 1·06, or 1·19 tons of coal.

The "effective coal equivalent" of the coke produced in the manufacture of the quantity of gas necessary, on our assumptions, to produce 4,500,000 "effective" therms, is arrived at in similar fashion.

SUMMARISED RESULTS.

—	Anthracite, 1 ton.	Coal, 1 ton.	Coke, 1½ tons.	Gas, 15,000 cb. ft.	Electricity, 800 units.
"Effective" heat ..	5,000,000	4,500,000	6,000,000	3,400,000	2,400,000
Cost (pence)	738	534	792	720	1,200
Relative cost (coal taken as unity) ..	1·38	1·00	1·48	1·35	2·25
Gross demand on coal resources (tons) ..	0·90	1·00	3·00	1·00 coal and 0·26 ton coke.	1·96

—	Estimated consumption to maintain room 20 ft. × 16 ft. × 11 ft. at 65° to 70° on cold day, from 8 a.m. to 10 p.m.	Cost of items in Col. 1.	Burning-hours for expenditure of about 8½d.
Coal	35 lb.	about 8½d.	14
Coke	40 lb.	,, 9½d.	about 12½
Gas	330 cb. ft.	,, 16d.	,, 7
Electricity ...	24 KW.H.	,, 36d.	,, 3¼

—	Mode of heating.			
	Coal.	Coke.	Gas.	Electricity.
Gross demand upon coal resources for production of 4,500,000 Therms. "effective" heat obtained by householder. (Tons)	1·00	2·25	2·45	3·75
Net demand, taking into account "effective" coal equivalent of by-products. ... (Tons)	1·00	1·18	1·17	3·75
Equivalent quantities	1·00	1·125	20,000 cb. ft.	1,470 KW.-hrs.
Cost ... ... (Pence)	534	594	960	2,205
Relative cost	1·00	1·11	1·79	4·13

It will be seen that the *net* draft upon our fuel resources is only about 18 per cent. greater in the case of gas and coke heating, but remains nearly four times as great for electric heating as compared with coal.

The *cost* for equivalent "effective" heating to the householder is nearly twice as much for gas and over four times as much for electricity compared with coal, but gas and electric heating make far less demand upon "service," and afford many advantages, *e.g.*, in point of cleanliness* and in ease of regulation. Such items enter importantly into the question of actual cost, with

* In the final report of the Coal Conservation Committee, it is mentioned (footnote p. 19) that the measurable damage done in Manchester and Salford by smoke is estimated at nearly £1,000,000 per annum.

which, however, we are not at the moment primarily concerned. The plain fact is that we have to consider not only our own fuel requirements, but also those of our Allies, and it is an imperative obligation upon every individual, in the present circumstances, to adopt every measure calculated to reduce the demand upon our coal resources in order that the fuel requirements of our Navy, of our Army, and of our Allies be not jeopardised.

Although some of the above comparisons are necessarily based upon rough estimates, it is recognised that the greatest avoidable waste of heat energy occurs in the consumption of fuel for "domestic" purposes, and the annual requirements in this direction are estimated at the respectable figure of 35,000,000 tons of coal. Hence householders and others have an opportunity of doing their "bit," and by care and attention, and the employment of common sense, it should be practicable substantially to reduce this figure during the next twelve months.

Ed. C. de Segundo.

London, E.C.
September 27th, 1918.

German Post-War Plans.

On behalf of the members of the Glass Industry Interim Industrial Reconstruction Committee, which has been formed (under the ægis of the Ministry of Reconstruction, the Board of Trade and the Ministry of Labour) of an equal number of representatives of Employers' Associations and Employés' Unions in every section of the glass industry, I hope you will allow me to call attention, through your columns, to the vital significance to this country of certain trade developments contemplated in Germany.

We learn from the German Press that after the war Germany will seek to restore her credit abroad by a concentration of effort upon the export of certain chosen manufactures. Chemicals are named as the first of these manufactures; then comes glass.

Now, Sir, the glass industry of the world is not in the first rank of importance in the eyes of Germany because of its relative size and volume, or because of the wealth it will *directly* bring to the German people. There is another and a greater reason than that. The reason for the choice of glass is this: that it is a key to the gate of many other industries. A nation holding the monopoly of glass could hold up nearly all other trades. We can make hardly anything without using glass at some stage of its manufacture, even if glass is not an actual part of the finished product.

Here usually glass is part of the finished product; perhaps in no great quantity; but, however small its use, wherever it is, it fulfils a *rôle* that is essential. Our welfare and comfort, in health and in sickness, our ships, our trains, our homes, our food—in almost every side and thing of life glass has its place.

And not in peace alone, but also in war.

When the history of the war is laid bare, it will be found that the difficulty of making glass for lenses and prisms, and for test tubes, crucibles, and retorts, hampered the work and equipment of our fighting forces to a dangerous extent, and tremendous efforts were needed to save the situation. When the history of the anti-submarine campaign is written, it will be found that glass played an important *rôle*.

Before the war, the British glass manufacturer and his men had, owing to Germany's hold, little chance of profit or employment. Under war conditions it has been difficult to produce the vital requirements of the country fast enough. There is now opening in this trade for investment of capital and for well-paid, skilled labour. Will it last? It will be in danger after the war if not supported in a prompt and practical way.

At a recent meeting of the Imperial War Conference there came up for discussion the freeing of industry in Great Britain from dependence on German dyestuffs. Now, you cannot make dyes or any other product without glass. Yet we do not read that the Imperial War Conference has discussed British dependence on German glass!

Our industry is ready to do its part; the manufacturer is ready to put into his works the best available plant, and the workmen are prepared to use this plant to the best advantage. This is a big job, but it does not frighten us. We only ask of our rulers and of the public that they will give to glass its proper position in the national life of the country.

We want to manufacture in Great Britain under conditions that will give (1) security and return to capital; (2) security and a return to brains (management and technical advisers); (3) security and substantial wages and good conditions of employment to our workers.

To put our trade in good position to meet the future, progress has already been made. In the Society of Glass Technology, we have a common meeting ground for labour, capital, science, and technics, and every branch of the industry is to be represented on our Committee and the District Councils under it. We are organising ourselves.

But this is not enough. Germany's rise has been attributed directly to the English policy of the "open door." We of the glass industry fear that the policy of the open door may be carried to such an extent that the British glass industry may become extinct.

On this point employers and workers think alike. Reform of this condition and help during our reconstruction period is not a political question but a business proposition. The German Government will spare no pains or expense to secure return to their virtual monopoly in optical and chemical glass, and their commanding position in glass generally, because they perceive very truly how that return would lead to supremacy in other industries and manufactures. The British glass industry does not intend to allow this return if it can help it. But we ask from our rulers some support. We do not ask them to bolster up an inefficient industry so that we may make profits at the expense of the nation, but we do ask that the industry be given the chance of full development, and that a "key" industry be saved from the hands of Germany, determined to capture it at all costs because it is a "key."

John Stokes,
Chairman of the Glass Industry Interim Industrial Reconstruction Committee.

London, N., *September 16th*, 1918.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The Brown, Boveri Motor-Car Engine-Starter.

Messrs. Brown, Boveri & Co., of Baden, Switzerland, have for some time been devoting attention to the subject of electric starters for petrol motor-car engines, and have recently taken out British patents in connection with an electric motor, so combined with the usual hand cranking arrangement that no space is, as in the usual location of the starting motor, taken up at the sides of the engine, thus leaving free access to the valves, carburettor, magneto, water circulating pump, &c.

As will be seen from the accompanying sectional drawing (fig. 1) the starting motor is enclosed in a casing at the front end of the engine. The crankshaft of the latter carries on its forward end the fixed half of a toothed or jaw clutch, while the sliding half is mounted on the rear end of the hand cranking-up shaft. The sliding half is toothed on both sides or faces, and is capable of being engaged both with the jaws on the end of the crankshaft and also with the jaws forming part of the gear wheel M. The latter is also capable of being slidden axially together with its jaw clutch by means of the electromagnet E fixed on the engine casing, the body of the gear wheel M serving as the armature of the electromagnet. The wheel M is driven from the starting electric

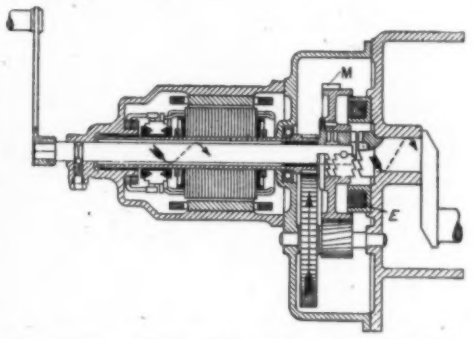


Fig. 1.—Sectional Elevation of Brown, Boveri Electric Petrol Engine-Starter.

motor through a train of three gear wheels. The motor armature is fixed on a hollow shaft surrounding the hand cranking-up shaft, which also carries the primary driving pinion. The arrangement is such that when the electric starter is brought into use the electromagnet is energised, the gear wheel M being drawn to the rear, so locking into one block the three jaw clutches. When the engine is started by hand only the rear pair of clutches are enmeshed, that connected with the electric motor being left out of gear.

As illustrated, the arrangement would appear to have the drawback that when the electric starter is in use the hand starting crank is also being rotated at a high speed, to the possible danger of passers-by; however, doubtless the designers intend that the actual handle shall be of the detachable type, so that it can be stored away in one of the car's lockers, and only brought into use in case the starter, owing to a discharged battery, should fail to operate, or other emergency.

Device to Facilitate Transposition of Line Wires.

While the work of stringing wires on pole lines is under way, and it is desired to transpose the positions of the wires of a pair on insulators, the work is greatly facilitated by the use of a recently patented device known as a transposition yoke.

As shown in fig. 2, p. 324, the yoke is equipped with wire carriers swivelled to it so that the wires of each pair may be readily transposed, or one pair of wires may be transposed with respect to another pair of wires, all without disconnecting the wires from the carriers or relaxing the stringing tension.

The bar, to which each pair of wires is connected by loops, is swivelled on the bolt supporting it, but is ordinarily prevented from rotating on the bolt by its engagement with the flattened

part of the bolt shank illustrated in the small figure. In transposing, the bar is raised sufficiently to clear the flattened part of the bolt, and is then turned so as to transpose the wires. The same may be done with the bar to which both of the bolts are

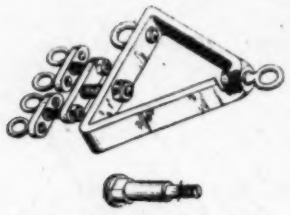


Fig. 2—Transposition Yoke.

connected, permitting the transposition of one pair of wires with respect to a second pair of wires.

The device was invented by Harry C. Williams, of Irvington, N.J.—*T. and T. Age.*

BUSINESS NOTES.

To our Correspondents.—We shall be glad if our correspondents will remember that all communications intended for the use and information of the Editors should be so addressed. Criticisms of the inexperience and strange Press standards of some publicity representatives receive full confirmation when items of personal interest intended for editorial use are addressed to the "Advertisement Manager" or the "Advertisement Department." It is not our practice to include in the Electrical Review personal or trade references as a consideration for advertisement business received, nor to insert matter purely on the ground of personal friendliness with anybody. The adoption of anything below a Grade I standard would open the way to endless abuses, and would justifiably shake the confidence in, and respect for, the Electrical Review that we modestly believe the industry to have.

Training for Foreign Trade Service.—America is taking up the question of her foreign trade with all the imaginative enthusiasm of youth. Here is a development that may well be emulated in our country. As far back as December, 1915, Dr. R. P. Claxton, Commissioner of Education for the United States, called a Conference for the purpose of discussing the question of training Americans for the foreign trade service, which had already become a prospect of vast importance. General Swiggett, Specialist in Commercial Education for the Bureau of Education, became chairman of a main Committee to investigate the methods followed by leading commercial nations to train for foreign service. The latest development is the appointment of a powerful Advisory Council.—*Financier.*

Import Prohibitions.—By Proclamation the importation of time-recording instruments of all kinds, and movements and parts thereof, is prohibited, save under special licence from the Board of Trade.

"Neutral" Activity.—The German machinery for conducting trading operations through neutral countries is apparently getting to work. In addition to the evidence that has been forthcoming from other directions, and to which we recently referred at length, we now gather from a Christchurch dispatch to the *Daily Mail* that many New Zealand firms have received letters from neutral countries making tempting business offers, it is believed on behalf of Germany. "One writer frankly states that he is ready to overcome the difficulty of communication between New Zealand and the countries engaged in war." The letters have been placed before the Government authorities.

Mr. Hughes, the Australian Prime Minister, in a communication to the British Empire League, refers to the need for having a simple and definite origin mark as a means of identifying genuine British goods. In his opinion it is absolutely necessary, in view of the practical certainty that after the war the enemy will pass his goods off as British or Allied if he can get the chance to conceal their true origin. It was a quite usual practice before the war for firms to import German goods, and then mark them with a British firm's name or trade-mark. For such a practice very heavy penalties should be imposed. However patriotic British purchasers may be, they will be only too easily defrauded unless a British origin mark is introduced.

An After-War Exhibition at Birmingham.—Arrangements are on foot for holding simultaneously early in the year after next, assuming that the war does not last too long to make that date impracticable, three British Industries Fairs at London, Birmingham, and Glasgow. We have before us printed particulars respecting the Birmingham scheme, which is under the official organisation of the municipality and of the Chamber of Commerce of Birmingham. The three Fairs, though running simultaneously, will not overlap in regard to class of exhibits, for the classes of manufactures shown at London and Glasgow will not be shown at Birmingham. This will, it is thought, be a convenient arrangement for the oversea buyers who are expected to flock to these shores in search of British manufactures immediately transport facilities are available after the end of the war. They will know that they can find all articles of a similar nature grouped together at one of the three cities. We do not think that electrical manufacturers will need to be greatly persuaded concerning the importance of exhibition displays to bring them into direct touch with foreign and Colonial visitors, assuming that the time is right and that the exhibition is of such a character as to place their manufactures amid suitable surroundings. The latter point is affected to some extent by such matters as classification of exhibits, so we may mention that the principal classes in which electrical firms will be interested are the following :—(2) Lighting, where electric light fittings, table and hall lamps, standard lamps, &c. (*not* electric pocket lamps, which are generally shown at the London Fair), and appliances and glassware can be displayed ; (12) Cooking and heating stoves of all kinds, giving a good opportunity for the effective display of electrical appliances in a branch of the industry which has an unlimited future. There are in the Birmingham programme some other sections of less direct electrical bearing, such as machine belting, engineers' tools, small machine tools, &c. The Fair will not be run for private profit. Firms connected with the sections of the industry interested in the Birmingham event can obtain full particulars respecting provisional applications for space, terms, &c., from Mr. F. Greenwood, at the offices of the Chamber of Commerce, 95, New Street, Birmingham, or at 36, Oxford Street, London.

Bankruptcy Proceedings.—S. Smith (Smith & Sons), Widnes, "music and musical instrument dealer, electrical engineer and general dealer."—Application for debtor's discharge to be heard October 25th, at Liverpool.

Book Notices.—"Directory of British Manufacturers for Russian Trade." 1918. London : Russo-British Trade Exchange, Ltd., 16, Regent Street, S.W. 1. This is the second edition of this directory, which is edited by R. A. Lenski, and is published in the Russian language for circulation in Russia. Its object is to place in the hands of Russian merchants an epitome of representative British and Canadian manufacturing and trading houses, and in the course of its 700 pages all branches of business are included.

We have received a copy of the first number of the *Decimal Educator* (September, 1s.), which is to be issued quarterly to further the work of the Decimal Association (212 and 213, Finsbury Pavement House, E.C. 2). The journal is the new official organ of the Association, "established to promote the adoption of a decimal system of coinage and of the metric system of weights and measures in the United Kingdom." The issue contains an historical sketch of the Association, and the other contents include short articles, amongst others, on the Balfour Report, the Metric System in the Textile Industries, on Teaching the Metric System and Instruction for Adults, the Present Position of the Metric System in the British Empire and the United States, and one entitled Arguments for Decimalists. The journal will be found to contain much interesting matter, and all those who are interested in the movement should possess a copy.

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXXVII. No. 9. September, 1918. New York : The Institute. Price $1.

Liquidations.—Moore Radiator Tube Co., Ltd.—Creditors must send particulars of debts, &c., to the liquidator (Mr. G. G. Poppleton, 26, Corporation Street, Birmingham) by October 12th.

Bynoe Low-Pressure Superheater System, Ltd., and Low-Pressure Superheating, Ltd.—Meetings called for October 30th, at 1 and 2, Great Winchester Street, E.C. 2, to hear an account of the winding up from the liquidator, Mr. F. Morse.

List.—Messrs. Belling & Co., Derby Road Works, Montague Road, Edmonton, N.—Illustrated folder giving brief particulars and prices of a variety of types of their electric fires.

Cable Urgently Needed.—The Guildford Electricity Supply Co., Ltd., is in urgent need of a short length of cable for repairs (5 to 10 yards lead-covered TCC cable ; outer conductor, ·25 ; two inners, ·50. Advertisements have brought no response. Can anybody help?

Moon Chart.—Messrs. C. A. Vandervell & Co., Ltd., have sent us the moon chart for October, compiled by their chief engineer, Mr. A. H. Midgley. We hope that not many more moons will wax and wane before this kindly attention becomes unnecessary.

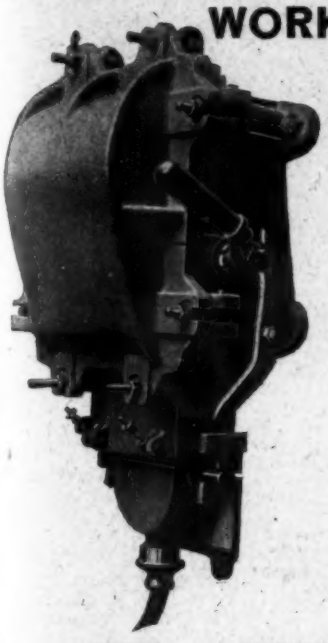
Non-Ferrous Metal Industry Act.—Lists of further firms or individuals to whom licences have been granted appear in the *London Gazette* for October 1st.

Trade Announcement.—The Concordia Electric Wire Co., Ltd., desire all communications to be addressed to their head office and works (Trent Mills, New Sawley, Derbyshire). A branch office and stores have been opened at 155, Victoria Street, Westminster, S.W. 1.

VERITYS LTD

ENGINEERS,

WORKS: ASTON, BIRMINGHAM.



"ASTON" GASTIGHT SWITCH,

WITH TWO-PIN INTERLOCKED PLUG.

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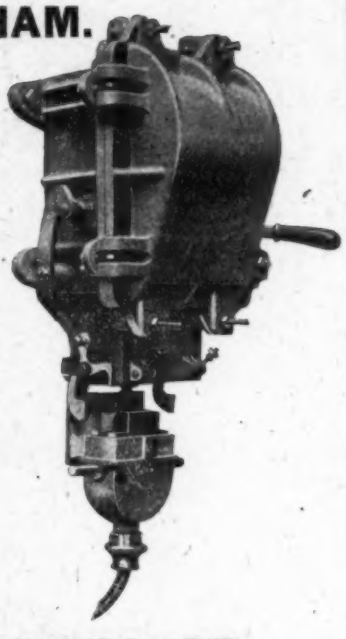

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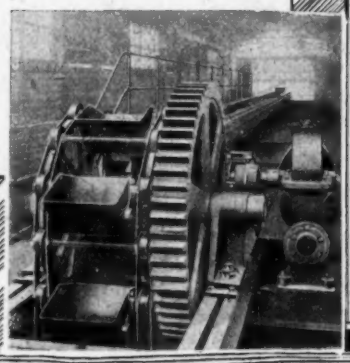

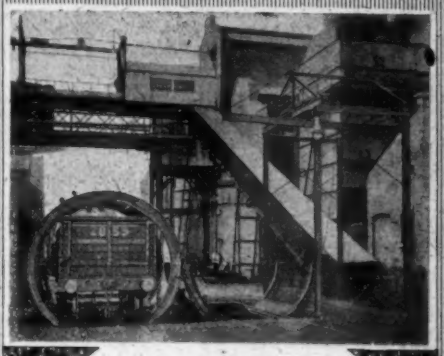

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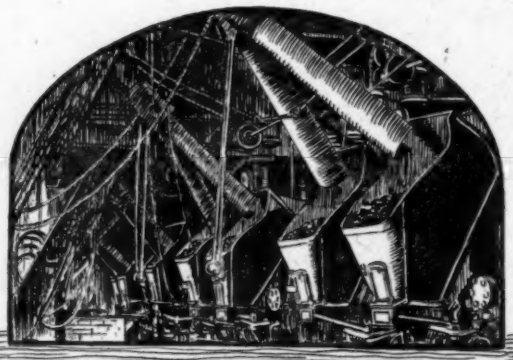

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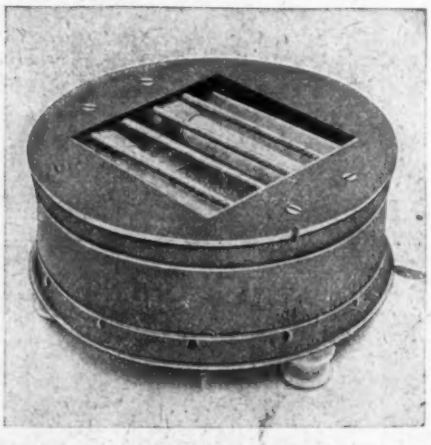

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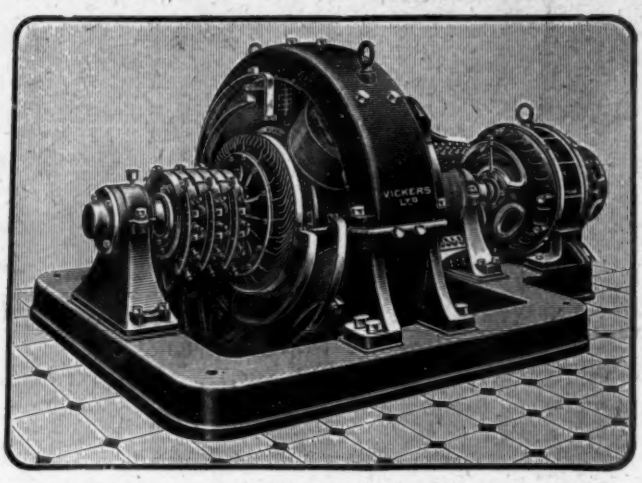

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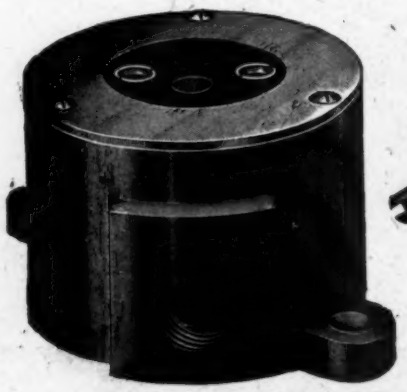

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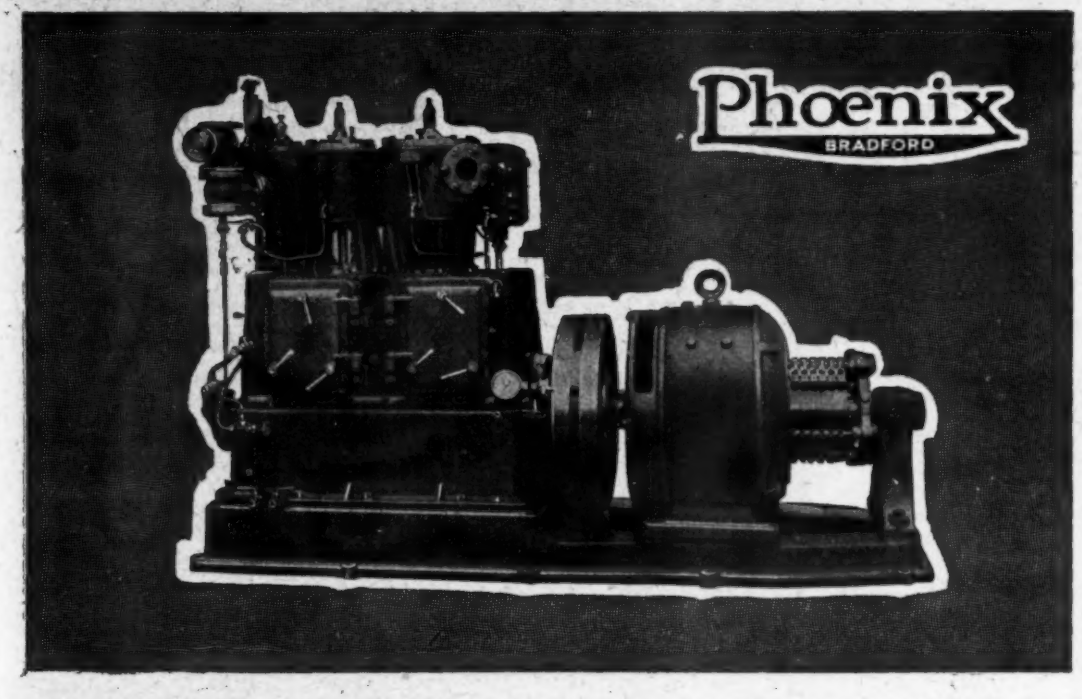

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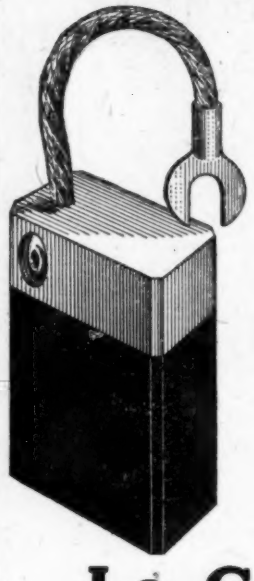

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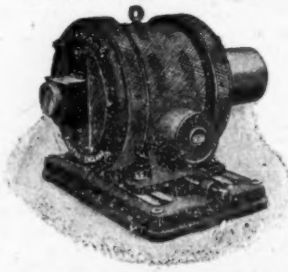

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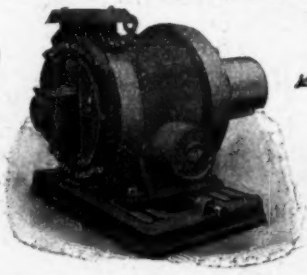

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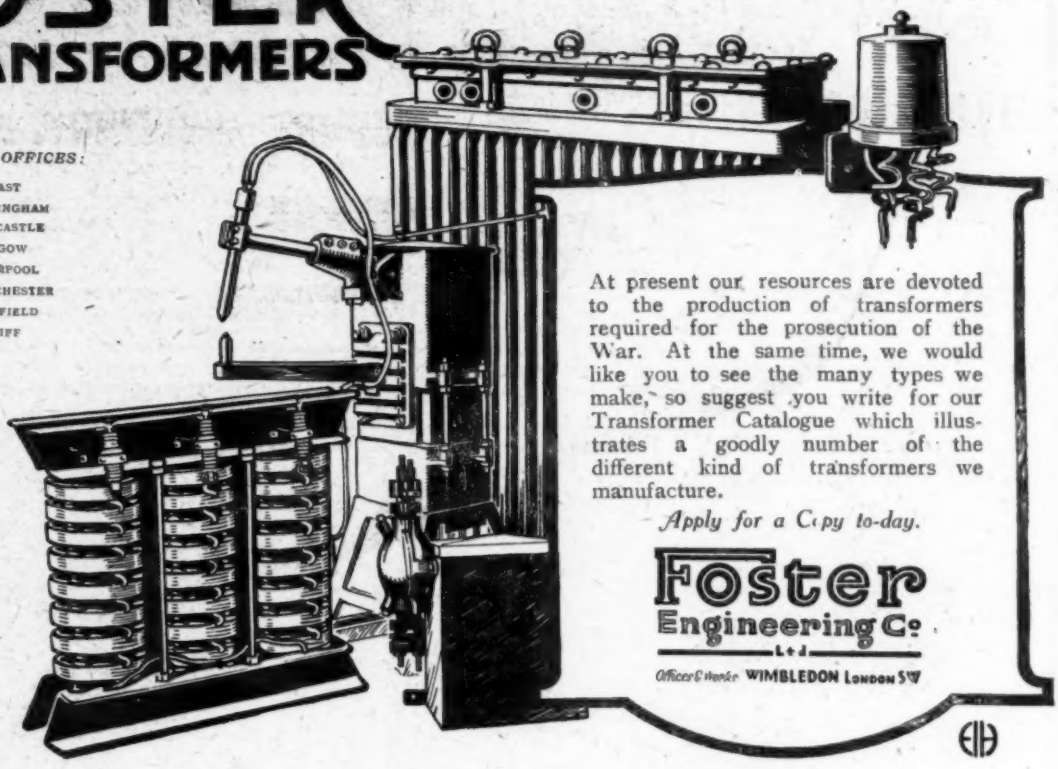

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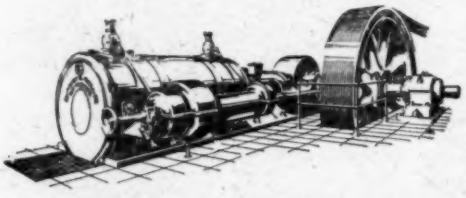

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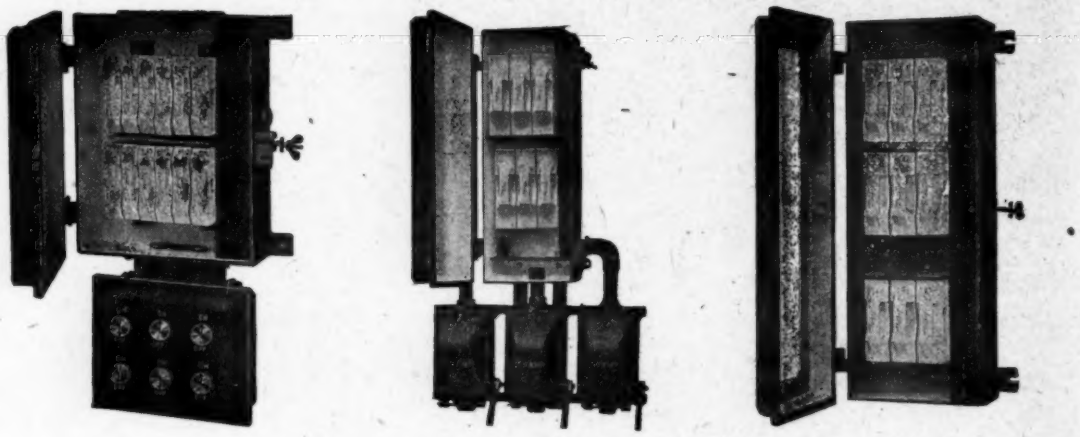

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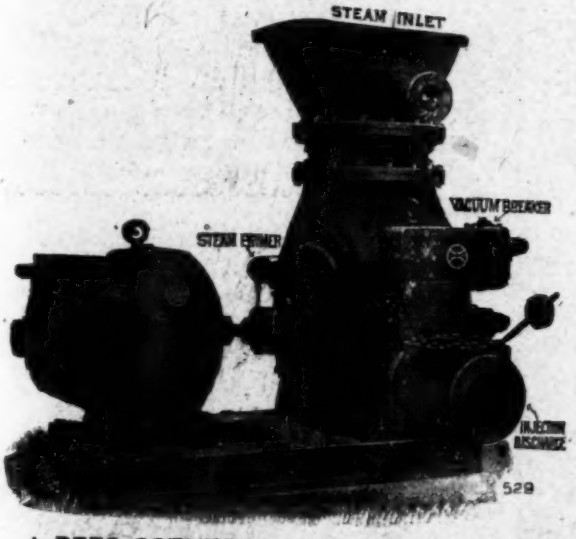

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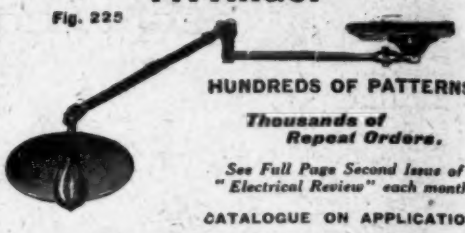
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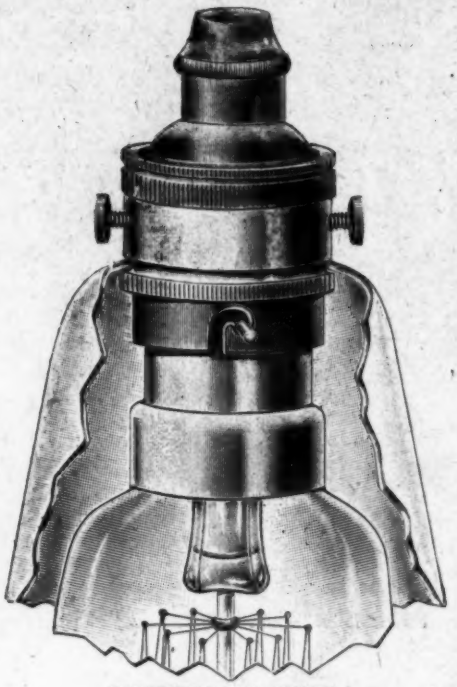
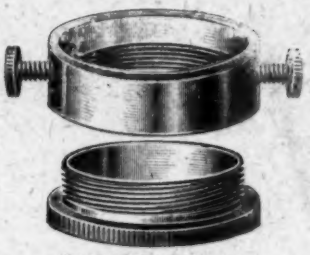


"EASIFIX" Lamlok SHADE CARRIER IN POSITION.



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The ELECTRICAL REVIEW is the recognised medium of the Electrical Trades, and has by far the LARGEST CIRCULATION of any Electrical Industrial Paper in Great Britain.

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SITUATIONS VACANT.

Latest time for receiving 9.30 a.m. Thursday.

If letters are not to be delivered to certain firms or individuals (if known), instructions to that effect should be sent to the Manager of the ELECTRICAL REVIEW, who will do his best to carry out such instructions. Letters of applicants cannot in such cases be returned to them, nor can the names of Advertisers using a number in any way be disclosed.

Original Testimonials should never be sent.

SWITCHBOARD ATTENDANT.

WANTED, Switchboard Attendant conversant with E.H.T. 3-phase and D.C. three-wire Switchgear and running of Turbo-Alternators, Rotary Converters, &c. Salary 65s. per week, inclusive of all recognised awards, plus a sum dependent on conditions.

Applications stating age and experience, with copies of testimonials, endorsed "Switchboard Attendant," to be sent in, on or before MONDAY, OCTOBER 14th to P. P. WHEELWRIGHT, M.I.E.E., Borough Electrical Engineer, Jubilee Street, Blackburn. 2778

SHIFT ENGINEER.

SHIFT ENGINEER wanted at once (controlled undertaking): experience of B. & W. Boilers, Turbo-Alternators, and E.H.T. A.C. Supply essential. Salary £3 17s. 6d. per week (inclusive of all bonuses to date), plus overtime rate for any additional time worked.

Apply, stating particulars of age, training and experience, with copies of recent testimonials, to—

THE ENGINEER,
Electricity Works, Redditch, Worcestershire. 2771

SHIFT ENGINEER.

SHIFT ENGINEER, at the Eccles Corporation Electricity Works (certified undertaking). Must have good electrical and mechanical experience. Wages £3 10s. to £3 15s. per week (inclusive of all bonuses) according to qualifications.

Applications, stating age, experience, when at liberty, &c., with copies of recent testimonials, to be forwarded forthwith to the BOROUGH ELECTRICAL ENGINEER, Electricity Works, Cawdor Street, Patricroft, Lancs. 2775

SITUATIONS VACANT.—*Continued.*

SUPERINTENDENT EMPLOYMENT DEPARTMENT.

FOREMAN wanted by large electrical concern to take charge of manufacture of electrical instruments for industrial purposes. Applicant must be able to supervise both male and female labour on machining and assembling operations, fix piecework prices, and have had experience in a responsible position on similar work. Permanent and progressive position. No one already on Government work will be engaged.

Apply, with particulars of experience, age, and salary required, to your nearest EMPLOYMENT EXCHANGE, mentioning No. A 6123. 2786

FITTER.

FITTER, at the Eccles Corporation Electricity Works (certified undertaking). Must be a first-class man, with good experience in power station repair work. Good wages offered to suitable man.

Applications, stating age, experience, wages required, when at liberty, &c., with copies of recent testimonials, to be forwarded forthwith to the BOROUGH ELECTRICAL ENGINEER, Electricity Works, Cawdor Street, Patricroft, Lancs. 2776

ENGINEER-IN-CHARGE.

ENGINEER-IN-CHARGE required for certified undertaking; alternating current experience essential. 52 hours per week. Salary £172 18s., including war awards to date.

Apply, with full particulars and copies of testimonials, to BOROUGH ELECTRICAL ENGINEER, Electricity Works, Tunbridge Wells. 2754

ASSISTANT SHIFT ENGINEER.

ASSISTANT SHIFT ENGINEER required in Generating Station; must have had experience with Turbines and Reciprocating Engines and A.C. and Traction Supply.

Apply, stating age, experience and wages required, to THE BOROUGH ELECTRICAL ENGINEER, Corporation Electricity Works, Factory Lane, Croydon. 2770

ASSISTANT LECTURER.

THE GOVERNING BODY of Battersea Polytechnic require immediately a full time temporary Assistant Lecturer in Electrical Engineering. Salary £200 and war bonus.

Particulars on application to the SECRETARY, Battersea Polytechnic, London, S.W. 11. 2790

CABLE JOINTER.

CABLE JOINTER wanted for Underground Three-wire Cable System; must have good experience in mains and services and locating of faults.

Apply, stating experience and wages wanted, to BURGH ELECTRICAL ENGINEER, Corporation Electricity Works, Alloa. 2679

(*Continued on next page.*)

SITUATIONS VACANT.—*Continued.*

SWITCHBOARD ATTENDANT.

SWITCHBOARD ATTENDANT wanted for A.C. and D.C. Generating Station; must have had experience with E.H.T. 3-phase plant. Wages 57s. 6d., plus 12½%, per week.
Apply, stating experience, with copies of recent testimonials, to CHIEF ENGINEER, Electricity Works, Luton. 2763

SWITCHBOARD ATTENDANT.

SWITCHBOARD ATTENDANT wanted in Lighting and Traction Station. Wages according to experience.
Applications, with references, stating experience, age, &c., to be sent to BURGH ELECTRICAL ENGINEER, Perth. 2785

SHIFT ENGINEER.

SHIFT ENGINEER wanted for A.C. and D.C. station (certified undertaking); must have had experience with Turbines and E.H.T. 3-phase Plant. Wages £3 5s. (plus 12½ per cent.) per week.
Apply, giving full particulars, to the BOROUGH ELECTRICAL ENGINEER, Corporation Electricity Works, Leigh, Lancs. 2695

ELECTRICAL POWER ENGINEERS' ASSOCIATION.

The Protective Association for Technical Engineers engaged in the Electricity Supply Industry.

MEMBERS of the E.P.E.A. who had intended applying for the post of Engineer and Manager of the electricity undertaking of the Burgh of Darwen, at the very low salary offered of £300 per annum, are asked to first communicate with the HONORARY GENERAL SECRETARY, E.P.E.A., 37, Wallwood Road, E. 11. 5650

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ARMATURE Winders, used to repair shop, D.C. work. No person resident more than 10 miles away, or already on Government work, will be engaged.—Apply H. D. & S., 32, Newington Causeway, S.E. 1686

ASSISTANT Foreman Platelayer wanted; first-class man with experience of repairs and renewals of tramway permanent way. Wage £4 per week and overtime.—Apply, stating age and experience, with copies of testimonials, to GENERAL MANAGER, Corporation Tramways, Coventry. 2616

BOILER House Foreman wanted, London suburb, Certified Undertaking. Capable of taking charge of boiler house and carrying out repairs to boilers and plant. Wages 45s., plus 20s., plus 12½% for 54-hour week.—Apply, stating age, experience, &c., to 5654, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

CHARGE Engineer wanted, D.C. lighting and traction E.H.T. rotary. London district, Certified Undertaking. Salary, including bonuses to date, £200 per annum.—Apply, giving particulars of experience, age, &c., to 5655, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

CHARGE Engineer wanted for combined A.C. and D.C. station near Glasgow; also Switchboard Attendant.—Apply, giving full particulars of experience, age and wage expected, to 2635, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

CHARGE Engineers wanted for power house of 800 H.P., to run seven 8-hour shifts. Experience with gas and steam engines, and batteries desired. Must be ineligible for military service.—State age, wages required, with two references, to CHIEF ENGINEER, Blackpool Tower Co., Blackpool. 2788

COIL Winder wanted by manufacturers of control gear. Must be capable of taking charge of winding department. No person already on Government work will be engaged.—Apply, giving age, wages, &c., to your nearest EMPLOYMENT EXCHANGE, mentioning No. A6081. 2727

COMPETENT and fully qualified Buyer wanted by London manufacturing company. Conversant with engineering and instrument materials and parts and sources of supply. Must be energetic and keen buyer. No person on Government work, or living more than 10 miles away, engaged.—Apply, stating age, record of experience and salary required, to 5672, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

COMPETENT Electricians required immediately, full rates. No person resident more than 10 miles away, or already on Government work, will be engaged.—Apply W. T. CLARKE & Co., LTD., Electrical Engineers, 10, Silver Street, W.C. 1. 2757

DESIGN Department, North of England firm, requires Assistant with knowledge of either D.C. or A.C. machine design. Applicant must be over 25 years of age and preferably of low category. No person already employed on Government work will be engaged.—Apply, stating age, experience and salary required, to your nearest EMPLOYMENT EXCHANGE, mentioning No. A5950. 2736

SITUATIONS VACANT.—*Continued.*

DRAUGHTSMAN-Designer with technical knowledge required for the research department of a well-known firm of switchgear manufacturers. No person already employed on Government work will be engaged.—Apply, stating age, salary and experience, to your nearest EMPLOYMENT EXCHANGE, mentioning this paper and No. 2722.

DRAUGHTSMAN (junior) required for electrical engineering works at Edmonton. Previous electrical experience an advantage. No person resident more than 10 miles away, or already on Government work, will be engaged.—Reply, stating age, salary required, &c., to BELLING & Co., Derby Road Works, Edmonton, N. 18. 2762

DRAUGHTSMAN, with experience in small electrical switchgear, distribution boards, and electrical accessories generally. Progressive position for the right man. Commencing salary £3 10s. per week. No one employed on Government work, or resident more than 10 miles away, need apply.—Write, stating age and experience, to THE SUN ELECTRICAL CO., LTD., 57/59, Neal Street, Long Acre, W.C. 2617

DRAUGHTSMEN, senior and junior (Tyneside), for switchgear. No person already employed on Government work will be engaged.—Apply by letter, stating age, salary, and experience, to your nearest EMPLOYMENT EXCHANGE, mentioning this paper and No. 2666.

ELECTRICAL Engineers with thorough Commercial experience required as Managers and Assistant Managers for branch establishments entirely engaged on war work. No applicants will be considered who are eligible for military service, or already on Government work.—Apply by letter to MANN, EGERTON & Co., LTD., 177, Cleveland Street, London, W. 1. 5661

ELECTRICIAN required for Estate Installation, consisting of gas engines, gas producer plant, electrically-driven pumps and sawmill, lighting, telephones and bells. Good wages to a suitable man; preference given to a discharged Army man.—2642, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICIAN wanted for Colliery in Durham County, with experience in maintenance and repairs to three-phase, high-tension and D.C. machinery; good winder preferred. No person engaged on Government work need apply.—Applications to be sent to nearest EMPLOYMENT EXCHANGE, quoting reference No. A6119. 2768

ELECTRICIANS and Mates required. No person resident more than 10 miles away, or already on Government work, engaged. — ENGINEERING WORKS (LTD.), 7, Great Winchester Street, E.C. London Wall 5428. 5653

ENGINE Driver, for high-speed reciprocating engines. A discharged soldier or sailor who has some knowledge of the work will receive first consideration.—Full particulars to ENGINEER, Electricity Supply Co., Guildford. 2773

EXPERIENCED Foreman or Forewoman required to take charge of flashing and mounting department, carbon filaments. No person resident more than 10 miles away, or already on Government work, will be engaged.—9728, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

FOREMAN and Storekeeper wanted by electrical engineers, one accustomed to the manufacture of heating and cooking appliances; discharged soldier considered. No person resident 10 miles away, or already on Government work, need apply.—2687, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

IMPROVER wanted in a 3-wire D.C. electricity works. Excellent opportunity.—Apply, stating age, training and wages expected, 2789, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

INSTRUMENT Makers, Tool Makers, and Setters wanted for urgent Government work; also Floor Inspector. Must be first-class men. No person resident more than 10 miles away, or already on Government work, will be engaged.—Address FULLER ACCUMULATOR CO., LTD., Grove Road, Chadwell Heath. 2744

JUNIOR Shift Engineer required for large electric power station (certified undertaking), A.C. and D.C. Good experience and prospects. Wages £3 weekly inclusive rate.—Apply SHROPSHIRE, WORCESTERSHIRE & STAFFORDSHIRE ELECTRIC POWER CO., Power Station, Downing Street, Smethwick. 2761

PATENT Agency.—Wanted a competent man (ineligible), as Electrical Engineer-Assistant, in the business of Patent Agency in a large office in London; should possess Degree or Diploma of Technical College.—Apply, with details of training and experience, and statement of salary expected, to Box 752, Reynell's, 44, Chancery Lane, W.C. 2. 5647

(*Continued on next page.*)

SITUATIONS VACANT.—*Continued.*

PAVIOR or Working Permanent Way Foreman required for tramway track, regular work.—Apply, stating age, experience, present position, references and wages required, to BURTON AND ASHBY LIGHT RAILWAY, Swadlincote, near Burton-on-Trent. 5559

PUBLICATION Assistant wanted for compiling technical data and engineering catalogues. Either a well-educated young lady or an ineligible man, preferably with some engineering knowledge. Must possess good knowledge of English and some initiative. No person already employed on Government work will be engaged.—Apply, stating age, previous experience and salary required, to your nearest EMPLOYMENT EXCHANGE, mentioning this paper and No. A6024. 2590

REPRESENTATIVE required for country districts with connections and experience. Suitable terms to a good man. No person resident more than 10 miles away, or already on Government work, will be engaged.—5567, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

REPRESENTATIVES wanted in London and Provinces, to undertake the sale of Electrical Lighting and Heating Specialities. Applicants must have a connection with most electrical contractors, engineers, &c. Good salary and commission to live men. No person resident more than 10 miles away, or already on Government work, will be engaged.—2733, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

REQUIRED, Three Adult Males and One Junior, suitable for preparation of manufacturing layouts. Must be capable of calculating weights and quantities of material necessary for manufacturing articles used by telephone and electrical engineers, and able to read drawings, micrometers, define and describe sequence of operations. Progressive permanent berth. No man already engaged on Government work need apply.—Apply your nearest EMPLOYMENT EXCHANGE, mentioning No. A6126. 2759

SHIFT Engineer Junior wanted, A.C. and D.C.. Midland power station. Pay £3 weekly, including all war bonuses to date. —Apply with full particulars to 2667, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

SHIFT Engineer required for hydro-electric power station in North Wales. Suitable post for discharged soldier with electrical experience.—Apply with references, stating wages required, to 2600, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

SHIFT Engineer required for 3-wire D.C. station in Midlands. No night shift.—Reply stating age, experience, and wages required, to 2767, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

SHIFT Engineer wanted for Hydraulic Power Station in North Wales. Must be experienced in large D.C. Generators, A.C. and Transformer Plant. No person already employed on Government work will be engaged.—Apply, stating salary expected, to your nearest EMPLOYMENT EXCHANGE, mentioning No. A5902. 2676

SHIFT Engineer wanted, 3-wire, D.C., station with battery. Certified Undertaking. Babcock & Wilcox boilers and turbine experience preferred.—Apply, stating qualifications, age, medical category and wages required, to MANAGING ENGINEER, Banbury and District Electric Supply Co., Ltd., Banbury. 2720

STOKER wanted for electricity works (certified undertaking) near London. Wages £3 3s. per week, including war bonus and 12½%.—2765, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

SUB-STATION and Switchboard Attendant wanted, E.H.T. and D.C. rotary. London district.—Apply, stating age, experience and wages required, to 5680, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

SUPPLY Undertaking (certified occupation) at seaside town in West has vacancy for outside Working Foreman to do wiring work and keep motors and meters in repair; able to do occasional jointing on cables. Permanency for suitable man. Wages (including bonus) £3.—State age, experience and medical category, to 2657, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

SWITCHBOARD Attendant, for three-wire D.C. board, with feeder and battery boosters, also small A.C. board. A discharged soldier or sailor who has a slight knowledge of the work will receive first consideration.—Full particulars to ENGINEER, Electricity Supply Co., Guildford. 2772

SWITCHBOARD Attendant required, with a view to taking charge of a shift in a generating station.—State age, experience and wages required, to 2783, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

TECHNICAL Assistant wanted by motor control gear manufacturers in London District. Must be conversant with the details of design and manufacture of all classes of motor control gear. No person on Government work, or living more than 10 miles away, engaged.—Apply, stating age, experience and wages required, to 5569, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

SITUATIONS VACANT.—*Continued.*

WANTED, a Finisher; state price. No person on Government work, or living more than 10 miles away, engaged. — H. NORRIS, 61, Malden Hill Gardens, New Malden, Surrey. 5668

WANTED, an Assistant (ineligible), for private electrical generating station.—Apply, full particulars experience, age, wages, &c., to SECRETARY, Pryce Jones, Ltd., Newtown, Mid Wales. 2725

WANTED, an Overhead Linesman; must be capable man· Good wages paid.—Apply, giving age, experience, wages required, and copies of references, to MANAGER, Mexborough and Swinton Tramways Co., Dale Road, Rawmarsh. 2766

WANTED at Once, a Competent Man to re-wind armatures· and do general repairs for a D.C. plant at a colliery in North Wales.—State wages, and give full particulars of experience, to 2669, ELECRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, by a firm in the S.E. district engaged on munition work, first-class Telegraph Mechanics. No person resident more than 10 miles away, or already engaged on Government work, will be engaged. — State age and experience to 6125, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, by leading engineering insurance company, Electrical Surveyors, having good knowledge of the theory and practice of alternating and direct current plant. Applicants must be ineligible for the Army or Navy.—2581, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, Car Shed Workers, night duty; wages 1s. 3d. per hour, average hours 65; for small running repairs and brake adjusting.—Apply, stating full particulars, to G. H. BROWN, Esq., Engineer & Manager, Mexbro' & Swinton Tramways Co., Dale Road, Rawmarsh, Yorks. 2739

WANTED, Constructional Engineer, experienced in the design and lay-out of generating stations. Permanency.—Apply, stating full particulars, together with copies of testimonials and salary required, to 2630, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, Costs Clerk, chiefly electrical work, preferably one who has had experience in store-keeping. Good prospects to suitable man.—Apply, stating full particulars of past experience, together with copies of testimonials and salary required, to 2631, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, Electrical and Mechanical Engineer, for controlled works, factory plant, consisting of suction gas and Petter oil engines, 500 KW., direct current, 220 volts. Must be able to maintain and carry out installation work and repairs, and be responsible to the chief engineer for efficient running. Permanency for man of proved ability in routine and control of men. No person already on Government work can be engaged.—Apply your nearest EMPLOYMENT EXCHANGE, giving age, references and wages required, quoting No. A6088. 2734

WANTED, experienced Meter Tester, used to the calibration and repair of alternating-current three-phase and direct-current watt-hour meters.—Applications, stating wage required and when duties can be commenced, to the GENERAL MANAGER, Electricity Department, Dunning Street, Sunderland. 2755

WANTED, first-class Armature Winders. No man on Government work, or resident more than 10 miles away, need apply.—MACDONALD, SYER & CO., LTD., 295, Gray's Inn Road, W.C. 1. 2625

WANTED, fully qualified Electrical Meter Repairer.—State age, wage required, in addition to standard bonuses, and enclose references, to CITY ELECTRICAL ENGINEER, Lincoln. 2740

WANTED, General Assistant to Works Manager in an old-established electric lamp factory. Good opening and progressive salary. No person already on Government work will be engaged.—Apply your nearest EMPLOYMENT EXCHANGE, mentioning No. A5667. 2037

WANTED (London Central), Junior Test Room Assistants (females considered) for the calibration of ammeters and electrical instruments. No person resident more than 10 miles away, or already on Government work, will be engaged.—State wages required and give full particulars, 2760, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, Storekeeper Packer for Wholesale Electrical Accessories (West End). No one living more than 10 miles away, or already on Government work, need apply.—2756, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

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SITUATIONS VACANT.—*Continued.*

WANTED, Sub-station Attendant for certified undertaking; E.H.T. system. Man accustomed to synchronous motor-generators, battery, together with boosters. Wages 55s. per week, plus 12½ % bonus.—Apply by letter only, endorsed "Sub-station Attendant," SOUTH LANCASHIRE TRAMWAYS COMPANY, Atherton, Lancs. 2784

WIREMAN, first-class, start at once. No person resident more than 10 miles away, or already on Government work, will be engaged.—Apply F. TROY & Co., 194/6, Finchley Road, N.W.3 5664

WIREMAN Wanted, power, lighting; also an Assistant for repair shop, with fair knowledge of armature winding, &c.; highest wages. London work. No person resident more than 10 miles away, or already on Government work, will be engaged.—2751, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WORKS Manager with special knowledge of mass production of telephones and kindred electrical apparatus, including magnetos for spark ignition. Must be first-class all-round organiser, experienced mechanic, good man of methods, and used to the sole control of large works (2000 employés). Only those having held similar positions need apply. Write only in first instance, stating fully experience, age, and salary required. Liberal terms to man of first-class ability.—STERLING TELEPHONE & ELECTRIC CO., LTD., 210, Tottenham Court Road, W. 1. 2781

SITUATIONS WANTED.

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A COMMERCIAL Engineer, of first-class practical engineering and manufacturing experience, with sound technical knowledge, contemplates change; capable organiser, energetic and tactful in control of staff; considerable experience in negotiation of trading agreements.—5583, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

A GENTLEMAN with exceptional experience and technical ability, wants a responsible position with reputed firm manufacturing electrical instruments, meters, or signalling-gear, &c. Excellent testimonials.—5678, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ADVERTISER requires position as Switchboard Attendant on H.T. plant. Six years' experience on L.T. work. Technical and mechanical training. Discharged from the Army. London district.—5561, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

AN Engineer, Mechanical and Electrical, with first-class theoretical and practical experience, contemplates change, Accustomed to running and management of large electrical plants. Capable organiser and experienced in the management of men.—5674, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

AN Engineer, with 25 years' experience in mechanical and electrical engineering, accustomed to large plant and to the management of men, seeks position as Manager or Outside Representative.—5616, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ARMATURE Winder, first-class, seeks good position, conscientious and systematic worker. Charge hand preferred. 5638, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ASSISTANT Engineer desires an appointment; over 12 years' experience in the generation and distribution of electrical energy.—5311, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

CHINESE Electrical Engineer, B.A., B.Sc., with good connections and two years' works experience, desires position in large electrical firm with a view to being representative of same after war in China. Disengaged.—5666, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

DRAUGHTSMAN, Electrical (22), grade 3. Shortly disengaged.—5679, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICAL Engineer, A.M.I.E.E. (27), Grade 2, seeks appointment; design of electrical apparatus, 6 years' radio experience, testing and experimental work, technical experience in large manufacturing concern; good references.—5555, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICAL Engineer seeks administrative position. Wide experience on erection and maintenance of power stations, batteries, works electrification, designing, estimating; good organiser and administrator.—5657, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ELECTRICAL Engineer (33), A.M.I.C.E., A.M.I.E.E., with college training and experience in instrument and research work, desires permanent responsible post.—5634, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

SITUATIONS WANTED.—*Continued.*

ELECTRICAL Engineer (48), seeks permanent appointment, charge of installations, gas, steam, oil engines, motors, lifts, telephones, cars, 25 years' practical experience, highest references.—"ENGINEER," c/o Vincent, 78, St. James' Road, Southsea, Portsmouth 5658

ELECTRICIAN Assistant seeks light situation, age 16½, good experience.—S. ISAAC, 106, Chrisp Street, Poplar. 5621

ELECTRICIAN (discharged) wants maintenance job; experienced D.C., 3-wire, batteries, rotaries and wiring.—G. H. HAYWARD, 15, Pakenham Street, Mount Pleasant, W.C. 1. 5584

ELECTRICIAN (exempt), desires change, motors, lifts, lights, &c., factory work.—G. S., 46, Mayton Street, N. 7. 5604

ELECTRICIAN requires job to carry out new work only; charge preferred. Over age.—MATTHEWS, 24, Thornhill Square, Camberwell, S.E. 5. 5644

ENGINEER-Electrician, charge hand, 22 years' all-round experience; low category.—5620, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

ENGINEER-Millwright shortly disengaged. A thorough all-round practical man, doing all own erecting, own repairs, both electrical and mechanical; 22 years' experience in charge of large works. Salary £6 weekly.—"ENGINEER," 64, Longfield Street, Wandsworth, S.W. 5662

FOREMAN Armature Winder desires change. Excellent technical education, good organiser, used to A.C. or D.C. new and repairs, used to male and female labour, strict disciplinarian and energetic.—5677, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

FOREMAN-Electrician (33), competent all-round mechanic.—37, Argyle Street, Leytonstone, E.11. 5625

INSTRUMENTS.—Administrative position wanted. 16 years' practical electrical instrument experience. Salary £400 to commence.—5628, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

MINING Electrician, recently returned from West Africa, desires re-engagement. Thorough knowledge of both D.C. and A.C.—5651, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

OFFICER, M.I.E.E., expecting disharge shortly, will be open for travelling—technical appointment; knowledge of combustion apparatus and patent law; own side-car set; can drive car, can fly R.E. 8.—B, 35, Pembridge Villas, W. 11. 5671

ORGANIZING and Methods Engineer seeks similar position. Good references.—5643, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

YOUNG Man, discharged Army, desires post, electrical and mechanical, installation, upkeep private plants, supply station experience.—5670, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

PARTNERSHIP.

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PARTNERSHIP (active) required after the war by an experienced Electrical and Mechanical Engineer, University graduate, A.M.I.Mech.E., A.M.I.E.E., in an electrical and mechanical consulting firm, or would consider an opening in an established manufacturing firm. Capital available. Not farther North than Manchester. Principals only; no agents.—Reply in confidence to 5639, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

AGENCIES.

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AUSTRALIAN Officer (M.C.), Melbourne, small capital, desires Agencies for general engineering equipment. Good education; well connected. Fair technical knowledge of electrical installation work. Highest English and Colonial refs. Leave due.—5641, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

GENTLEMAN travelling Yorkshire and Lancashire, with good central showrooms, stores and offices, desires Agencies, electrical accessories, apparatus or machinery.—5590, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

LOCAL Agents wanted in every town to collect old Electric Lamps on Commission.—Write, 104, Craven Park, London, N.W. 10. 4932

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FOR SALE.

MACHINERY FOR SALE.

GENERATING SETS, D.C.

One 300-KW. Belliss-E.C.C., 460/500 volts.
Three 266-KW. Belliss-Siemens, 460/500 volts.
One 220-KW. Willans-A.E.G., 220/230 volts.
One 200-KW. Allen-Parker, 460/500 volts.
One 185-KW. Browett-Lancashire, 460/500 volts.
One 180-KW. Anderson-Mavor 220/230 volts.
One 160-KW. Belliss-G.E.C., 460/500 volts.

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One 1000-KW. A.E.G., 500 volts, 50-cycle, 3-phase, with condensing plant complete, the whole equal to new.
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One Crompton, 150-H.P., 25-period, 3-phase, slip-ring.
One Westinghouse, 100-H.P., 400 volts, 50-period, 3-phase, squirrel cage, 940 revs.
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One Westinghouse, 200-KW., 500-volt D.C., 280 revs., single bearing.
One 72-KW. Bipolar Compound-wound Generator, by Siemens, 110/120 volts.
One 14-KW. Bipolar, Compound-wound, by Parsons, 110 volts, 126 amps., 750 revs.
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All the above are ready for immediate despatch.

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13 ELECTRIC FIRES (job stock):—
Six 750-watt 200—220-volt.
One 1000 " 200—220 "
One 2000 " 230—250 "
One 3000 " 100—110 "
Two 3000 " 220—230 "
Two 3000 " 200—220 "

Three "Ensign" Fires (job stock):—
Two 200—220-volt 1500 watts.
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4 gross Lamp Holders, C.G., S.C.
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100,000 1½" Porcelain Cleats, 2 and 3-groove.
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Small quantities of Enamelled Iron Shades, 9" and 10".

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MODERN 500-KW. GENERATING SET.

COMPRISING

BROWETT, LINDLEY Totally Enclosed Vertical Engine; 19-in. and 36-in. cylinders, by 18-in. stroke. Metallic packings, piston valves, drum governors, fly-wheel and barring gear.

GENERATOR.—Direct coupled, by Lancashire Dynamo Co.; 500/550 volts, 1000/1200 amperes. Compound wound; 240 revs. Tachometer, &c., &c.

Seen as left off work.

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FOR Sale, Motor-Generator, direct-coupled, motor-wound, 200/220 v.; Generator, 80/100 v., 100 amps., D.C.; double automatic enclosed Starters, 220 and 440 v.; one set of boiler water-guage Fittings, complete with protectors.

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FOR SALE.—*Continued.*

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ONE Parsons Steam Turbo, 1500 KW., 2-phase, 2000 volts, 50 periods.
One Willans-Parsons Steam Turbo Set, 1200 KW., with Alternator, 1200 R.P.M., 200 lbs. to sq. in., 11,000 volts, three-phase, complete with exciter, also condensing plant, air, and circulating water pumps, &c.
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One Surface Condenser, by J. & H. McLaren, capacity 3000 cls per hour, with circulating pump.
Two Exciters, 180 volts, 80/100 amps., 200 R.P.M. 5277

FOR SALE.

TWO 1,000-KW. C.C. Generating Sets, each complete with condenser, air pumps, grease extractor, steam and exhaust pipes, and, if required, switches, circuit-breaker, and rheostat.

The engines are of the cross-compound, vertical Corliss type, one by Cole, Marchent & Morley, Ltd., and one by John Musgrave and Sons, Ltd., and the generators are of the engine type of Westinghouse make.

Steam pressure, 160/180 lbs. per sq. in. Speed, 85 R.P.M.

These sets, which are in excellent condition, may be seen running, and arrangements can be made for prospective purchasers to witness steam consumption tests.

The engines can be used for rope-driving by removing the generator armatures and substituting rope pulleys.

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ONE Motor, D.C., 300-B.H.P., by Bruce Peebles, multipolar, compound wound, open type, 3 bearings, 440 volts, from 240 to 312 speed, shunt regulator for varying speed, 280/420. Slide rails and starting switch.
One Motor, D.C., by Brush Electrical Co., 7½-B.H.P., 500 volts, 1,460 R.P.M., 6 × 4 pulley.
One Motor, D.C., by British Westinghouse, 1·9-B.H.P., 440 volts, series wound, 550 R.P.M., no pulley.

All in good condition.

P. P. WHEELWRIGHT,
Borough Electrical Engineer,
Jubilee Street, Blackburn. 2743

(*Continued on next page.*)

FOR SALE.—*Continued.*

FOR SALE.

Delivery from Stock.

110 VOLTS.

Three 3-H.P. Motors, 1350 R.P.M.
One 10-H.P. Dynamo, Shunt, 1050 R.P.M.

230 VOLTS, SINGLE-PHASE, 50 CYCLES.

One ¼-H.P. Single-Phase, 1000 R.P.M.

200/250 VOLTS. D.C.

Three 1/17-H.P. Series Motors.

One 1/7-H.P. Shunt	"	1900 R.P.M.
One 1/6-H.P.	"	1725 "
Four ¼-H.P.	"	1600 "
Two ½-H.P.	"	1600 "
Five 1-H.P.	"	1600 "
One 1½-H.P.	"	1200 "
Nine 2-H.P.	"	1300 "
Five 3-H.P.	"	1200 "
One 10-H.P.	"	1000 "
One 11-H.P.	"	740 "
Three 12½-H.P.	"	1225 "
Two 50-H.P.	"	700 "
One 29-H.P.	"	940 "
One 30-H.P.	"	1120 "
Two 35-H.P.	"	870 "
Two 37-H.P.	"	580 "
One 41-H.P.	"	1050 "
One 45-H.P.	"	720 "
One 62-H.P.	"	750 "

All new machines.

One 23-H.P. Generating Set, Belliss Engine and Siemens' dynamo, 250/260 volts, 460 R.P.M., 50 lbs. steam pressure.

400/500 VOLTS, A.C., 50 CYCLES.

One ¾-H.P. Slip Ring, 700 R.P.M.
Five 1-H.P. Squirrel Cage, 700/1400 R.P.M.

One 1¼-H.P.	"	1420 "
One 1½-H.P.	"	1400 "
One 1¾-H.P.	"	1400 "
Seven 2-H.P.	"	1400/1440 revs.
One 2½-H.P.	"	950 R.P.M.
One 3-H.P.	"	940 "
Two 4-H.P.	"	980/1440 "
Two 5-H.P.	"	1100/1430 "
One 8-H.P.	"	1440 "

400/500 VOLTS, A.C., 25 CYCLES.

One 4-H.P. Squirrel Cage. 715 revs.
One 36-H.P. Slip Ring. 720 revs.
New machines.

440/550 VOLTS, D.C.

One 1-H.P. Shunt Motor,	1750 R.P.M.	
One 2-H.P.	2000 "	
One 4-H.P.	1100 "	
One 5-H.P.	1275 "	
One 5-H.P.	1000 "	
Two 8-H.P.	1030 "	
One 9-H.P.	1540 "	
One 10-H.P.	320/960 "	variable speed.
One 10-H.P.	1050 "	
One 12-H.P. Series	1000 "	
Two 12-H.P. Shunt	830 "	
Four 12-H.P.	820 "	
Two 12½-H.P.	1270 "	
Nine 14-H.P.	820/980 "	
One 15-H.P.	1100 "	
One 25-H.P.	1175 "	
Two 25-H.P.	880/1000 "	
Two 26-H.P.	750 "	
One 30-H.P.	500/1000 "	variable speed.
One 35-H.P.	1000 "	
One 38½-H.P.	725 "	
One 40-H.P.	880 "	
One 40-H.P.	900 "	
One 43½-H.P.	675 "	
Two 48-H.P.	775 "	

All new machines.

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250/300 A.C. and D.C. Starters, oil-immersed, Star Delta, and automatic.

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250, 70, 60, 57, 50, 37, 30, 25, 10 H.P., slip-ring.
100, 60, 40, 35, 32, 25, 20, 15, 10, 5, 3, 1 H.P., squirrel cage.
3 and 6 H.P., 220 volts, single-phase, 50 cycles.

400/460 VOLTS, D.C.

100, 80, 60, 20, 13, 11, 10, 7½, 3 H.P.

200/230 VOLTS, D.C.

50, 11, 10, 7½, 4, 3½, 3, 2, 1 H.P.

100/110 VOLTS, D.C.

5 H.P. and 70 amperes at 60 volts.

GENERATING SETS.

200-KW., 460-volt, direct-coupled Steam Set.
87-KW., 220-volt, ditto ditto
18-KW., 110-volt, ditto ditto

GAS ENGINE SETS.

Two 50-H.P., 230/325-volt, "Stockport E.C.C.," complete.

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Materials and workmanship, the Best. Technical advice given with quotations if required.

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"Howden" Enclosed Compound Engine for 150 lbs. steam pressure, direct-coupled to compound interpole generator, having an output of 300 KW. at 240 volts, 375 r.p.m.; built in 1910, and in first-class order.

Specification and print on request.

THE PHŒNIX ELECTRICAL CO.,
32—36, Broomielaw, Glasgow. 1943

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250-KW. Belliss-E.C.C. Set, comprising Belliss high-speed, 3-crank, compound engine, direct-coupled to E.C.C. generator, 440/460 volts, D.C., 560 amps., 380 R.P.M., with Körting ejector compound, also spare armature. Can be seen running by appointment.—BURY ELECTRICAL PLANT CO., LTD., Phœnix Street, Bury. 2746

(Continued on next page.)

FOR SALE.—*Continued.*

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Apply G. GILKES & CO., LTD., Kendal. 2747

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FOR disposal, 140-H.P. Gas Engine and Producer Plant, by Ruston Proctor, together with 460-v.. 80-KW. Dynamo, by E.C.C. Has not been run. Was to be used as a stand-by. Makers' full guarantees. What offers?

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FOR Sale, two 24", 110-volt, D.C. Ventilating Fans. Price £15 each.—THE PHŒNIX ELECTRICAL CO., 32—36, Broomielaw, Glasgow. 2701

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FOR Sale, 90-KW. modern Generating Set, by Browett, Lindley and Laurence Scott: 220 volts, 410 amps., 450 R.P.M. Engine, compound, developing full load at 160 lb. steam pressure on atmosphere; Generator, 6-pole compound wound; complete with new spare armature, and ready for immediate delivery. 5676, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

FOR Sale, 135-KW., 110-volt, 300 R.P.M., Engine type Generator, by Siemens.—THE PHŒNIX ELECTRICAL CO., 32—36, Broomielaw, Glasgow. 2699

FOR Sale, 290-KW. Bellis-Silvertown direct-coupled Generating Set, 600 volts, 490 amps., 350 R.P.M.; Generator 4-pole, shunt-wound; and compound Engine. Complete with spare Armature and Shunt Regulator; enamelled slate Switchboard suitable for above, consisting of generator panel and two feeder panels, with instruments and D.P. circuit-breakers, &c. The above plant is in thoroughly good order, open for inspection, and ready for immediate delivery.—83, The Exchange, Cardiff. 5675

(Continued on next page.)

FOR SALE.—*Continued.*

FOR Sale, 300-KW., 110-volt, 50-period, 300 R.P.M., single-phase Alternator, by Crompton, with direct-coupled exciter.—THE PHŒNIX ELECTRICAL CO., 32—36, Broomielaw, Glasgow. 2700

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12½-KW. Steam-driven Belliss-Westinghouse, 120-volt, D.C. Lighting Set. Immediate delivery; in new condition.—WESTERN ENGINEERING COMPANY, Swansea. 2729

14-B.H.P., Totally-enclosed, Compound-wound Mather & Platt Motor, 230 volts, D.C., 500 R.P.M., with or without magnetic brake of the "post" type. Reversing controller and resistances.—WESTERN ENGINEERING COMPANY, Swansea. 2730

500-KW. Steam Generating Set, comprising a Belliss triple-expansion engine, coupled to an alternator by the Electric Construction Co., Wolverhampton, 3000 volts, 50 periods, with Wheeler-Worthington independent surface condensing plant; modern plant in first-class condition, and for immediate delivery.—HARRY H. GARDAM & CO., LTD., Staines. 1851

500-KW. Steam Set, comprising triple-expansion enclosed engine, coupled to Westinghouse multipolar generator, 440/490 volts, D.C. For prompt delivery.—HARRY H. GARDAM AND CO., LTD., Staines. 1413

20,000 FLAME Arc Carbons, 6 mm. to 12 mm. diameter, 12" to 25¾" long, both metal cored and non-metal cored; also 500 33-mm. 10" cored Carbons: all to be sold cheap.—LAKE, 132, Upper Thames Street, London, E.C. 4. 2793

ARTICLES WANTED.

STOCKS PURCHASED.

STOCKS of Cable, Bell and Lighting Accessories, Lamps, &c., purchased for cash. Large and small quantities.

2675, ELECTRICAL REVIEW,
4, Ludgate Hill London, E.C. 4.

MOTORS WANTED.

1/16-TH H.P. to 20-H.P. Motors, all voltages, from 70 to 480-volt. State lowest prices, makers' name, and where same can be seen. Reply—

2774, ELECTRICAL REVIEW,
4, Ludgate Hill, London, E.C. 4.

ARTICLES WANTED.—*Continued.*

TO MANUFACTURERS.

ADVERTISER having large orders to place for all kinds of Bright Drawn Steel Bar, Bright and Black Bolts and Nuts, Screws, Springs, Washers and other material, invites correspondence with actual manufacturers.

2750, ELECTRICAL REVIEW, 4, Ludgate Hill, London, E.C. 4.

ELECTRIC OVERHEAD CRANE WANTED.

ELECTRIC OVERHEAD CRANE, 32' 2¾" centres of crane rails (or nearest), suitable for working 400 volts, direct current. State age, present condition, where situated and lowest price.

THOS. OXLEY, LTD.,
Shiloh Works, Sheffield.
'Phone: 4630. 'Grams: "Ironical, Sheffield." 2728

BRIDGE-MEGGERS AND RESISTANCES.

A QUANTITY urgently required for army use, immediate delivery.

Reply, describing type, condition of instrument and price, which should include delivery, to C. I. R. E. S., Woolwich Dockyard, to whom replies should be sent. 2745

Cheap prepaid Advertisements are inserted under this heading at the rate of One Penny Per Word (minimum 1s.).
Box Number and ELECTRICAL REVIEW address count as seven words.

ACCUMULATORS wanted for refining purposes. Obsolete Generating Sets, Dynamos, Motors, and all kinds of Machinery. Scrap Cable, Arc Lamps, Meters, Metal Residues, and Scrap Metals of every description purchased for prompt cash, town or country.—Apply A. BROWN & SONS, 142, Lower Clapton Road, London, N.E. Telephone: Dalston, 555. Telegrams: Secondhand, Lowclap, London. Established 1860. 4358

A.C. and D.C. Motors (second-hand), any type, any condition, wanted for prompt cash.—A. LEAROYD & SON, Bridge Works, Heatherley Street, Clapton, N.E. 5391

A.C. ¼ or ½-H.P. Motor, 204 volts, preferably second-hand; also Power Bench for sewing machines.—5673, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

A. LEAROYD & SON, Bridge Works, Clapton, N.E.—Telephone Dalston, 2278; Telegrams: Frangible, Lowclap, London—buys for prompt cash every description of second-hand Generating Sets, Accumulators, Motors, Transformers, old Arc Lamps, Meters, Cable, Scrap Metals, Metallic Drosses, &c., &c. Enquiries solicited. Established over 50 years. 5392

A1 CASH Prices given for Electric Cable, Flexible Wire, Electrical Accessories, &c.—Apply DAVIS, 11, Sun Street, E.C. 2. 1424

DYNAMO wanted, 220 volts D.C., 15/20 KW., 600 R.P.M., shunt or compound. Full particulars, condition, where seen, makers, age and lowest selling price.—2726, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

DYNAMOS, Motors, Arc Lamps, Meters, Scrap Cable, Iron, Metals or Machinery purchased for cash in any quantities.—J. HYAMS, 11, Glengall Terrace, Old Kent Road, S.E. Telephone: 3339 Hop. 5158

DYNAMOS, 3000 amps. at 6 volts. Would consider any offer down to 1000 amps. at any voltage from 2 to 8. EYRE AND SPOTTISWOODE, LTD., 10, New Street Hill, E.C. 4. 5665

GENERATORS, one or two wanted, 60/70 volts, 400/500 amps. D.C. Fullest particulars, lowest terms.—TILNEY, Olympia, Newport. 5457

MODERN compound-wound Generator, 230 volts, D.C. (belt driven), 25/35 KW.—Particulars and price. GATLEY & CO., Todmorden. 2737

NEW or Second-hand Tubing and Fittings wanted.—WALLACE, 58, High Street, Bloomsbury. 2307

OLD Electric Lamps that have had wire-drawn tungsten filaments in them previously wanted, glass parts intact. Agent's price 2d. each.—847, Harrow Road, London, N.W. 10. 4932

PLATINUM, in any form and quantity, purchased at highest prices by DERBY & CO., LTD., 44, Clerkenwell Road, London.

PLATINUM Scrap purchased in large or small quantities. Highest market value given.—Before selling elsewhere call or post to the old and reliable firm, THE DEPÔT, 156, Charing Cross Road, London. Established 1850. 5648

REQUIRED at once, second-hand, two 20-H.P. 200 or 100-v., A.C. Motors, single-phase, 83 periods, running at a speed of 850/1200 R.P.M.; two 25-H.P., 480-v. D.C., running at a speed of 685 R.P.M., with pulleys, slide rails and starters.—5645, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

(*Continued on next page.*)

ARTICLES WANTED.—*Continued.*

SMALL Electric Oven with hot plates for 200-volt circuit, for cash, or exchange Vacuum Cleaner.—GIRLING, Maldon, Essex. 2753

SPARE Armature and Brush Gear wanted for A.E.G. watt meter, 200 volts, 1000 amps., or firm to undertake repairs.—5642, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

STEEL Tubes, all sorts, wanted; Lampholders and Metal and Cardboard Shades; Gas Lighters, Static Electric; Screws, round head, and Hexagon Nuts.—DUGDILLS, Failsworth, Manchester. 5052

SUCTION Gas Plant and Engine; shunt-wound Dynamo, 100/150 volts, 40/50 amperes; 54-cell battery, 180 A.H. and main charging board, also 20-H.P. Motor, 460 volts, D.C.—Write, giving full particulars, to 5663, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

SURPLUS Stocks Electric Cable, Plant, &c., bought for cash; also scrap cable, dynamos, motors, cells, scrap metals, lamp ends, &c.—LAKE, 132, Upper Thames Street, London, E.C. 5473

WANTED, a few 400-volt, 50-cycle, 3-phase Motors, preferably slip-ring type, 5 to 35 H.P.—8133, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, Arc or Quartz Lamps, suitable for 200-volt, 60 periods, with accessories. Repairable lamps might answer.—THE LONDON ELECTRIC FIRM, Brighton Road, Croydon. 2742

WANTED, Diesel, or semi-Diesel, Generating Set of 200-KW. capacity, 220 volts, D.C., preferably with converter to run on tar fuel.—PORTHOLME AIRCRAFT CO., LTD., St. John Street, Huntingdon. 2682

WANTED, Direct-Coupled Steam Set, any output from 50/100 KW., will be considered; 440/480 volts, D.C.—State full details, price and where seen, to 2311, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, Electric Cooking and Heating Apparatus, Kettles, Irons, Vacuum Cleaners, all voltages. Also Electric Bells, Lamps and Arc Lamp Carbons, and all classes of Accessories and Flexibles. — Fullest particulars to 2316, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, Generating Sets, all sizes, Boilers, Accumulators, Dynamos, &c., for export: also Scrap Cable and Metals, Complete plants purchased.—WILLIAMS & SONS 37, Queen Victoria Street, London. Telephone: 3938 City. 7000

WANTED, Motor-Generator of approximately following capacities: D.C. Generator, output 130 amps. at 80—100 volts; Motor, 200 volts, single-phase, 50 periodicity.—Offers, with full particulars, to 2710, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, Motor-Generator, output 3/5 KW., for 100/150 volts, D.C. Price must accompany offer.—2434, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, Motor-Generator, 3-phase, 50-cycle, 415-volt, Motor-Generator, 800 to 1,200 amps., 30 to 40 volts. Full details.—BARNETT & SOANS, Electricians, Stoke-on-Trent. 5660

WANTED, Motor-Generator, 400 volts, one-phase, or 200 volts, two-phase, to about 70 volts, 80 amps.; also one 440 volts, D.C., ditto.—R. F. WINDER, Cross Belgrave Street, Leeds. 2360

WANTED, one copy "Electrician," 1917, July 20th.—2738, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, one 120-H.P. and one 60-H.P. Motor, A.C., 3-phase, 50 periods, 500 volts, pipe ventilated.—State speed and dimensions, with full particulars, JAMES TATTERSALL & SONS, LTD., Pitfield Mills, Bamford, Rochdale. 2749

WANTED, one 220-volt, compound-wound Generator, suitable for belt driving, 12—25-KW. capacity.—Reply, giving full particulars, to WHIPP & BOURNE, LTD., Castleton, near Manchester. 2662

WANTED, Small Three-phase Motors, with squirrel cage or slip rings, from 1 to 10 H.P., 50 cycles, 190 volts, with suitable starters for the larger sizes.—Reply OVERSEAS ENGINEERING COMPANY, LTD., 75, Curtain Road, E.C. 2. 2752

WANTED Squirrel-cage Motors, 440 volts, 40 cycles, up to 25 H.P., speed 750.—Give make and full details, price and where can be seen, to 2779, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

WANTED, 100-amp., 500-volt D.P. Ironclad Change-over Switch.—Prices and particulars to 2769, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

40-B.H.P. Motor, 220 volts, D.C. for Belt Drive. State speed.—F. B. HELLON, 57, Moorfields, Liverpool. 5656

MISCELLANEOUS.

WAR WORK WANTED.

VARNISH MANUFACTURERS producing Insulating, Synthetic and other Varnishes can accept orders for war work, and can execute with despatch.

GEORGE BENTLEY & CO., LTD.,
Belfield Old Road, Rochdale. 5603

Cheap prepaid Advertisements are inserted under this heading at the rate of One Penny Per Word (minimum 1s.). Three Consecutive Insertions for the price of two, if ordered and prepaid with first insertion.
Box Number and ELECTRICAL REVIEW address count as seven words.

ELECTRICAL Engineer and Draughtsman is prepared to undertake, in own time, the design of electrical and mechanical apparatus; also the working out of all details ready for the manufacture of same.—5462, ELECTRICAL REVIEW, 4, Ludgate Hill, London.

SHEET Metal Work Wanted, any kind; best workmanship at moderate prices.—A. V., 26, Pindar Street, Bishopsgate, London, E.C. 5626

Where Advertisements are to be answered to a given Number at the ELECTRICAL REVIEW Office Applications for Names and Addresses of the Advertisers will be entirely disregarded, and Letters giving incorrect Box Numbers will be destroyed.

EDUCATIONAL NOTICES.

Latest time for receiving, 9.30 a.m. Thursday.

SUCCESSFUL CORRESPONDENCE COACHING GUARANTEED for

A.M.I.E.E., A.M.I.C.E., A.M.I.M.E.,

City and Guilds Exams., Matriculation, B.Sc. (Eng.), etc.

Ten Years of Successes. —— *Personal Enquiry Invited.*

Up-to-date Courses to meet *your* particular needs in *any* branch of Electrical—D.C. or A.C., Civil or Mechanical Eng.

Special Courses in Practical Mathematics and Calculus.

ELASTIC PAYMENTS. STRICT PRIVACY. EXPERT ADVICE FREE.

A **"U.E.C."** COURSE will return you many times the outlay through the ADVANCEMENT SECURED professionally.

Apply *now* (saying what interests you) for the **"U.E.C."** No. 7 PROSPECTUS—FREE, to :—ADVISORY SECRETARY,

UNIVERSITY ENGINEERING COLLEGE, 3, St. Mark's Crescent, Regent's Park, London, N.W. 1—(No provincial branches.) 5649

The **MOLLER** Patent Dust-Proof **AIR FILTERS.**
See Advertisement Sept. 13th.
FILM COOLING TOWERS, LTD., 124, Chancery Lane, London, W.C. 2

No. 103. COUNTERWEIGHT SETS
BEST ENGLISH CHINA. WIDE-GROOVE PULLEY.
Rings stamped in ONE PIECE.
F. RYMAN, 116, Livery Street, BIRMINGHAM.

EVERY INSTALLATION ENGINEER
Should join his Trade Protection Organisation,
THE
ELECTRICAL CONTRACTORS' ASSOCIATION
(Incorporated).
Inquiries cordially invited by the Secretary—
L. G. TATE, 20, Bucklersbury, LONDON, E.C.

NOTICE.

OWING to the many hundreds of replies passing through this Office each week, we would ask those answering Advertisements to be EXTREMELY ACCURATE with regard to the figures WHEN ADDRESSING REPLIES to Box Numbers.

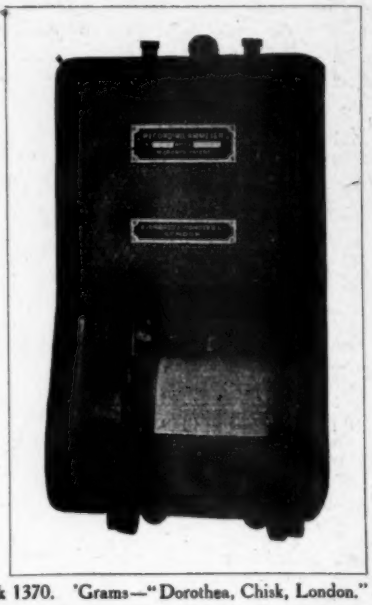
ALL

EVERSHED INSTRUMENTS

possess characteristic qualities which distinguish them from similar instruments of other makes. Take, for example,

RECORDING AMMETERS VOLTMETERS and WATTMETERS

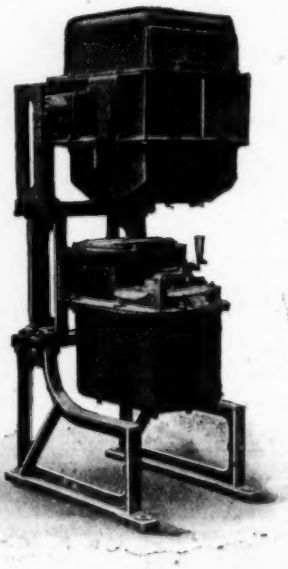
FOR ALL CONDITIONS OF SERVICE.



These instruments are the outcome of several years' manufacturing experience. Rectangular co-ordinates take the place of the usual curved lines, and the pen is of simplified design and gives a clear record on all circuits without clogging. The clockwork is simple and the chart roll continuous. If required, the chart can be detached daily. All movements have UNDAMAGEABLE PIVOTS, and the entire instrument is soundly constructed and well protected.

EVERSHED & VIGNOLES, Ltd.

ACTON LANE WORKS, CHISWICK, London, W. 4. 'Phone—Chiswick 1370. 'Grams—"Dorothea, Chisk, London."



E.A.C. IRON-CLAD OIL SWITCHES.

We are in a position to give ***QUICK DELIVERIES*** *of our "type D" loose handle oil switches for any pressure up to 6600 volts.*

We can supply them with either ***Watertight, Flame-proof*** *or* ***Explosion-proof*** *Casings for wall or floor fixing; and with or without* ***Draw-out Isolating Features.*** *The switches may be supplied singly or as complete Switchboards with bus-bar chamber, etc., or they may be combined with our Drum Type Starters on a Motor Control Panel.*

THE ELECTRICAL APPARATUS Co., LTD.

GLASGOW. 21, HOPE STREET. CENTRAL, 250.
BIRMINGHAM. CARLTON HOUSE, HIGH ST. CENTRAL, 7978.
HEAD OFFICE & WORKS:- VAUXHALL WORKS, SOUTH LAMBETH ROAD, LONDON, S.W.8. Telephone- BRIXTON, 2075. Telegrams- "ELAPRATUS LAMB." A.B.C. CODE. 5TH EDITION.
MANCHESTER. PALATINE BUILDINGS, VICTORIA ST. CITY, 9008.
NEWCASTLE-ON-TYNE. 25, BLOOM STREET. CITY, 937.

No. 109. COCUS ADAPTORS

STANDARD AND MINIATURE.
Also GENERAL ACCESSORIES.
PROMPT DELIVERY OF CLASS A ORDERS.
FREDERICK RYMAN, 116, Livery St., BIRMINGHAM.

OFFICIAL NOTICES.

Latest time for receiving 9.30 a.m. Thursday.

PORTSMOUTH CORPORATION TRAMWAYS COMMITTEE.

THE TRAMWAYS COMMITTEE of the above Corporation invite Tenders for the supply of the undermentioned goods from October 1st, 1918, to March 31st, 1919:—

Section A.—Ballast, Sand, and Grit.
Section B.—Portland Cement (British manufacture preferred).
Section C.—Brooms and Brushes.
Section D.—Oils (not lubricating), Chemicals, Sheet Glass, &c.
Section E.—Smith's Coal and Coke.
Section F.—Timber.
Section H.—Brake Blocks.
Section I.—Engine Packings, Asbestos Goods, &c.
Section J.—General Ironmongery.
Section M.—Steel Tramway Tires.
Section P.—Car Repair Stores.
Section Q.—Insulating Materials, Lamps, and Motor Windings.
Section R.—Overhead Line Materials.
Section S.—Lubricating Oils, Greases, &c.
Section T.—Chandlery, &c.
Section U.—Castings and Machined Parts.

The Specification and Form of Tender may be obtained upon application to the ENGINEER, Mr. V. G. LIRONI, M.I.M.E., A.M.I.E.E., Engineer's Office, Vivash Road, Fratton, Portsmouth.

Tenders, marked "Tender for ——," to be delivered to the Town Clerk, Town Hall, Portsmouth, not later than 10 a.m. on TUESDAY, OCTOBER 15th, 1918.

The Form of Tender must include a declaration that the person making the tender pays the rates of wages and observes the hours of labour and conditions contained in the Corporation Fair Wages Clause.

The Committee do not bind themselves to accept the lowest or any tender.

W. R. SPAVEN,
General Manager.

Town Hall, Portsmouth.
September 20th, 1918. 2671

COUNTY BOROUGH OF WARRINGTON.

Electricity Department.

THE ELECTRICITY AND TRAMWAYS COMMITTEE of the County Borough of Warrington invite Tenders for One Water-tube Boiler.

Specification and Form of Tender may be obtained from the undersigned on payment of one guinea, which will be returned on receipt of *bonâ fide* tender.

Five shillings will be charged for extra copies of the specification.

Tenders, addressed to the CHAIRMAN OF THE ELECTRICITY AND TRAMWAYS COMMITTEE, Town Hall, Warrington, must be sealed with wax and endorsed "Tender for Water-tube Boiler," and delivered not later than 12 o'clock noon, on TUESDAY, OCTOBER 22nd, 1918.

The lowest or any tender will not necessarily be accepted.

F. V. L. MATHIAS,
Borough Electrical and Tramways Engineer.

Howley, Warrington. 2787

OFFICIAL NOTICES—*Continued.*

BOROUGH OF BEDFORD.

Electricity Department.

NOTICE.

THE CORPORATION OF BEDFORD invite Tenders for the Supply and Erection of Two Water-tube Boilers, Mechanical Stokers and Induced Draught Plant.

Copies of drawings and Specifications may be obtained from the ENGINEER, Electricity Works, Cauldwell Road, Bedford, on the deposit of £1, which sum will be returned on receipt of a *bonâ fide* tender. Additional copies of the specification will be supplied at 5s. each.

Sealed tenders, marked "Boilers," to be delivered not later than noon, on the 13th day of NOVEMBER, 1918, addressed to the CHAIRMAN OF THE ELECTRICITY COMMITTEE, Electricity Works, Cauldwell Road, Bedford.

The Corporation does not bind itself to accept the lowest or any tender.

CHAS. STIMSON,
Town Clerk. 2741

NOTICES RELATING TO PATENTS.

Latest time for receiving 9.30 a.m. Thursday.

John E. Raworth,

Queen Anne's Chambers, 28, The Broadway, Westminster, S.W.1. **Chartered Patent Agent.**

THE PROPRIETOR of British Patent No. 21,881/14, dated November 2nd, 1914, relating to "Machine for Winding Electro-Magnetic Coils," is desirous of entering into arrangements by way of a license or otherwise, on reasonable terms, for the purpose of exploiting the above patent, and ensuring its practical working in Great Britain. All inquiries to be addressed to B. SINGER, 29, So. La Salle Street, Chicago, Illinois. 2723

THE
ELECTRIC TRAMCAR HAND-BOOK,
for Motormen, Inspectors, and Depot Workers.
By W. A. AGNEW.
Seventh Edition. 2s. net. Post Free 2s. 2d.
H. ALABASTER, GATEHOUSE & KEMPE, 4, Ludgate Hill, London, E.C.4

F. WIGGINS & SONS.
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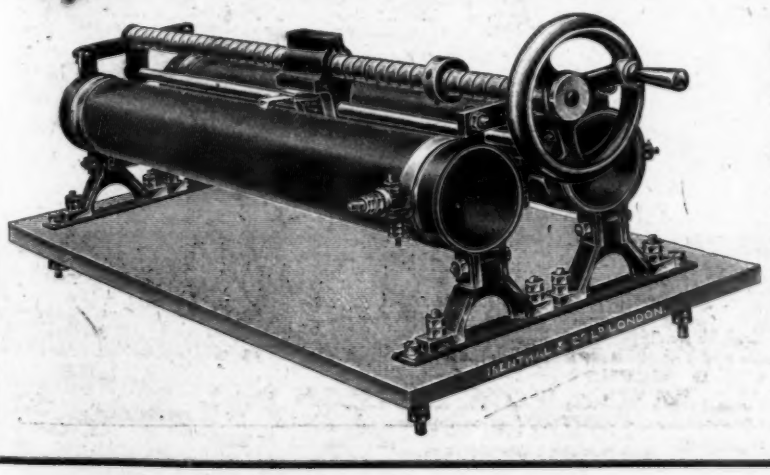
Telephone: Avenue 2248
FOR INSULATION.
Largest Stock in the World.
102, 103 & 104, Minories, LONDON, E.1.

HOOPER'S
Telegraph & India-Rubber Works, Ltd.
31, LOMBARD ST., E.C.3. (Established 1860.)
MILLWALL DOCKS, LONDON, E.14.
PURE TAPE AND STRIP, &C., &C.,
HOOPER'S Vulcanised India-Rubber Cables for Electrical Work maintain the highest quality, and their durability has been proved.
Telegrams: LINEAR, London. Telephone: 1169 Avenue & 84 East.

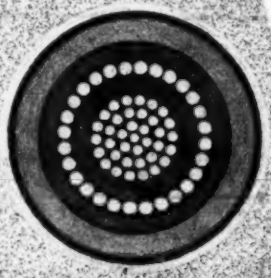


RHEOSTATS.
Sliding Contact Types
ISENTHAL & CO., LTD.
(Department 3),
DENZIL WORKS, WILLESDEN,
LONDON, N.W. 10.
Contractors to the India Office, Colonial Office, Postmaster-General, &c.

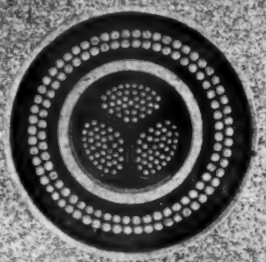
ENFIELD
ELECTRIC CABLES

PAPER INSULATED CABLES
RUBBER CABLES
LEAD COVERED AND ARMOURED CABLES
BITUMEN CABLES
TELEPHONE CABLES
TROLLEY WIRES
AERIAL CABLES

COTTON & SILK COVERED WIRES
COPPER WIRES & STRANDS
(PLAIN & TINNED)



L.T. CONCENTRIC, PAPER INSULATED, LEAD COVERED CABLE. (Actual Size.)



3 CORE SHAPED CONDUCTORS, L.T. PAPER INSULATED, LEAD COVERED, DOUBLE WIRE ARMOURED CABLE. (Diam. 2·75 inches.)

AGENTS and STOCKS

Messrs. ANDREWS & CO.
40 West Campbell Street
GLASGOW

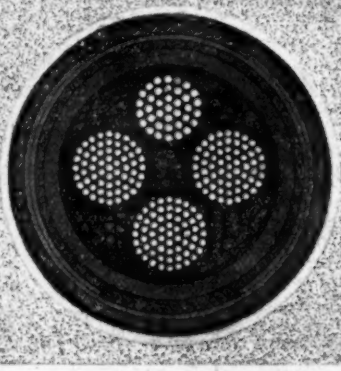
Mr. A. BERKELEY
45 Newhall Street
BIRMINGHAM

Mr. H. H. HOPKINS
16 John Dalton Street
MANCHESTER

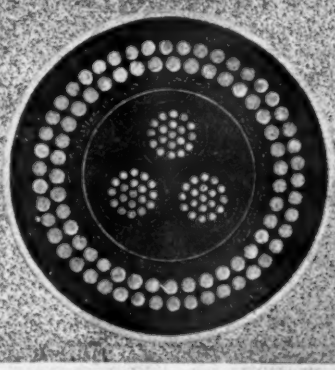
Mr. E. A. INGOLD
17 East Parade
LEEDS

Mr. F. RAWCLIFFE
19 Bank Chambers
24 Grainger Street
NEWCASTLE-ON-TYNE

Mr. C. ROPER
5 South Anne Street
DUBLIN



4 CORE L.T. PAPER INSULATED, LEAD COVERED, STEEL TAPE ARMOURED CABLE.
Supplied to Hendon Aircraft Factory. (Actual diam. 3·5 ins.)



3 CORE VULC. BITUMEN INSULATED, BITUMEN WORMED AND SHEATHED, DOUBLE WIRE ARMOURED MINING CABLE.
(Diameter 2·5 inches.)

Telegrams "ENFELCAMA, PHONE, LONDON"
Works "CABLES, ENFIELD"

Telephone LONDON WALL 1633, 1634

The ENFIELD ELECTRIC CABLE MANUFACTURING Co. Ltd.
Contractors to the British, French & Belgian Governments

~ WORKS ~
BRIMSDOWN, MIDDLESEX.

CENTRAL HOUSE
Finsbury Square, LONDON E.C.

Telephone: Museum. 333

TREDEGARS, Ltd.,

WHOLESALE AND EXPORT ELECTRICAL SUPPLIES,

9, Diana Place, Euston Road, N.W. 1,

Also at 47, Exchange Buildings, Birmingham.

THE FOLLOWING WE CAN OFFER YOU FROM STOCK:—

Extra heavy C.G. ⅜" and ½" S.C. HOLDERS.
Extra Heavy ⅜" and ½" S.C. CONDUIT HOLDERS.
Heavy C.G. ½" and ⅝" S.C. HOLDERS.
Heavy S.C. BATTEN HOLDERS.
Heavy Plain BATTEN HOLDERS.
Black Compo. S.C. BATTEN HOLDERS.
I.P. China Top S.C. HOLDERS.
K.C. all black Compo. S.C. HOLDERS.
Acid-proof S.C. HOLDERS.
½" Ediswan HOLDERS.
Keyswitch C.G. and ½" S.C. HOLDERS.
Push-bar C.G. and ½" S.C. HOLDERS.
H.O. SWITCH HOLDERS.
5 and 10/15-amp. Hardwood PLUGS and SOCKETS.
5 and 10/15-amp. Handshield ditto.
5 and 10/15-amp. All-china PLUGS and SOCKETS.
5 and 10/15-amp. FLUSH PLUGS, with heavy Brass Flange and China Plugs.
10/12-amp. Ironclad H.O. CUT-OUTS.
10/12-amp. Ironclad Combined SWITCH and FUSE.
Rosewood and Walnut ADAPTORS.
Black Compo. ADAPTORS.
All china ditto.
Miniature Cocus ditto.
35/40 S.J.V. Workshop FLEX.
14/36 D.R. Maroon Glace Cotton FLEX.
35/40 D.I.R., S.C.C. Glace Cotton FLEX (four colours).
35/40 20-mils. Cotton FLEX.
1/20 I.R., D.C.C. BELL WIRE.
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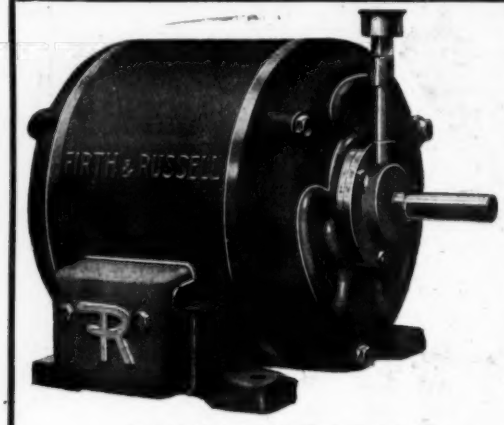

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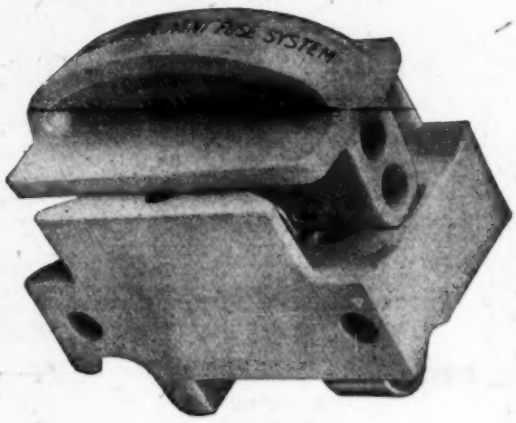

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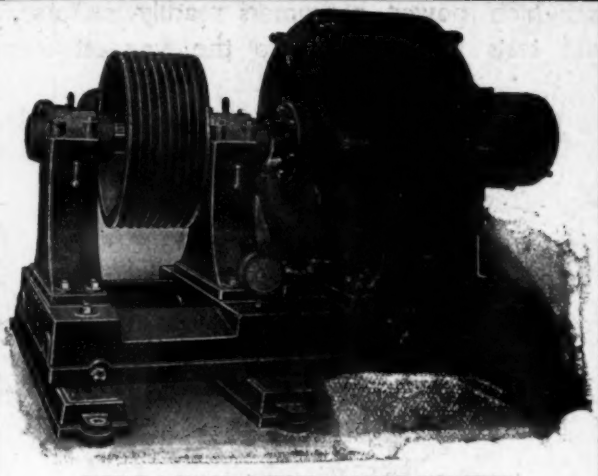

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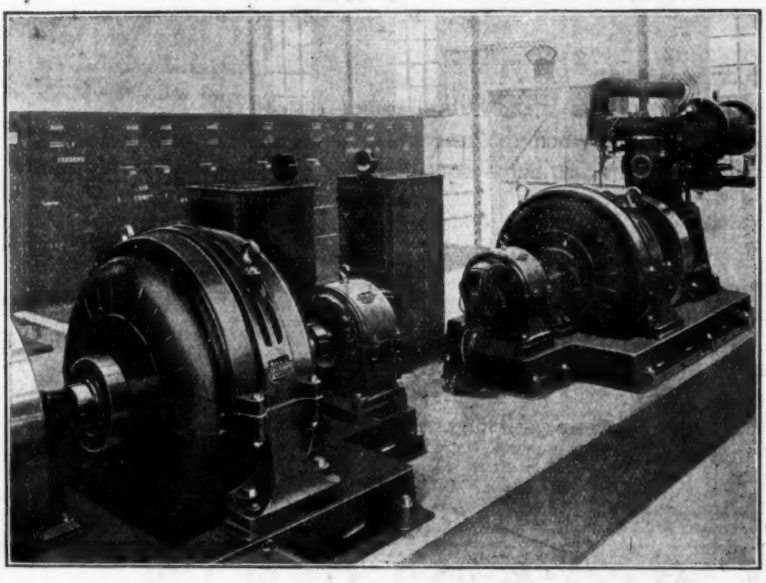

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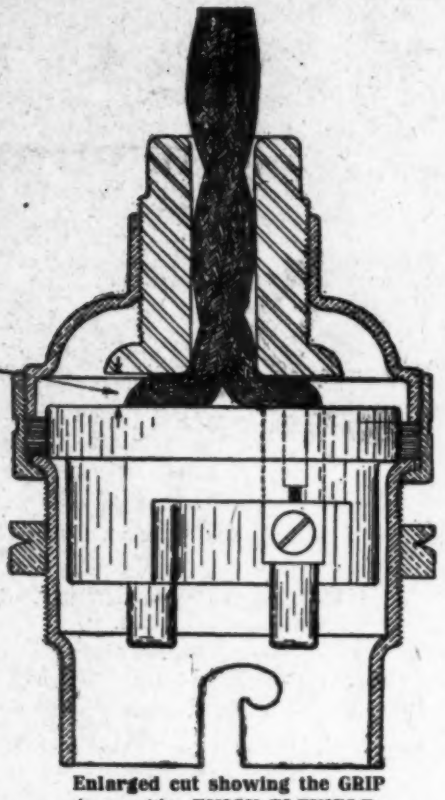

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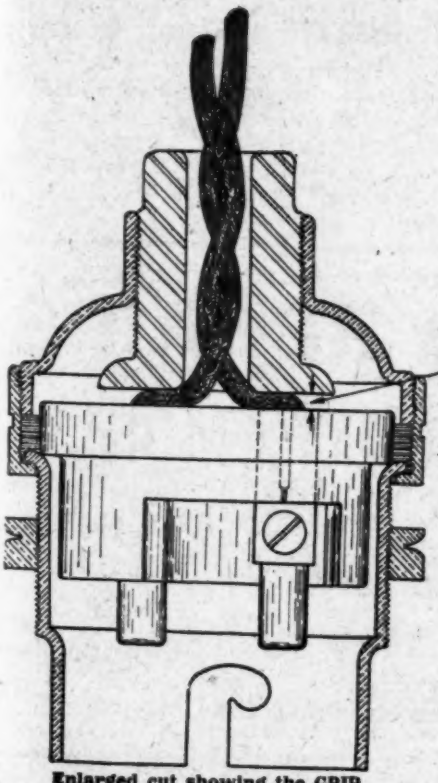

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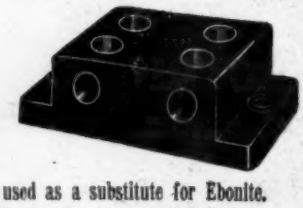

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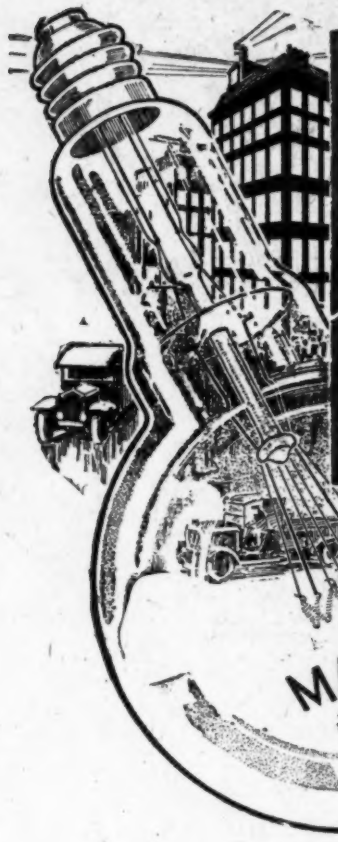

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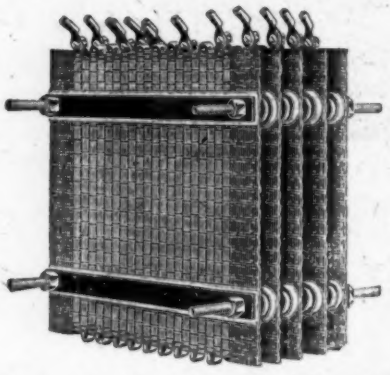

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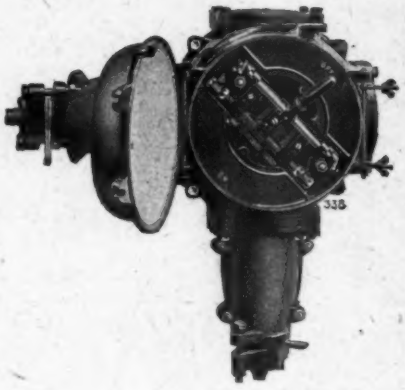

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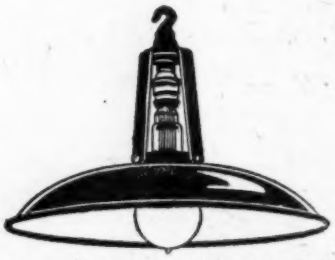

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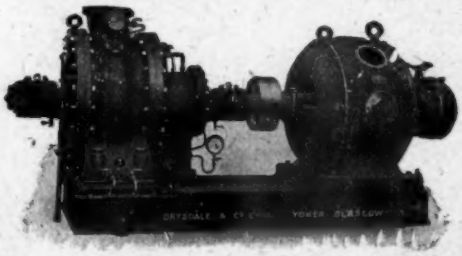

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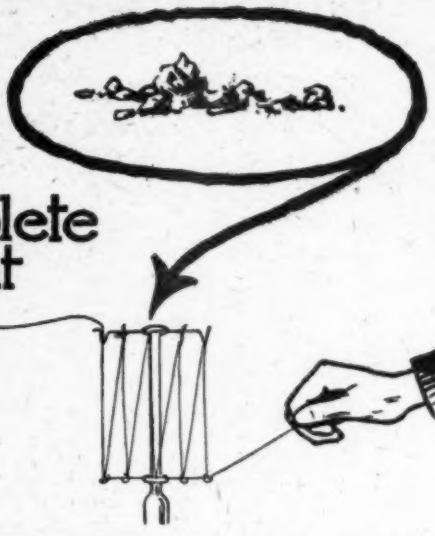

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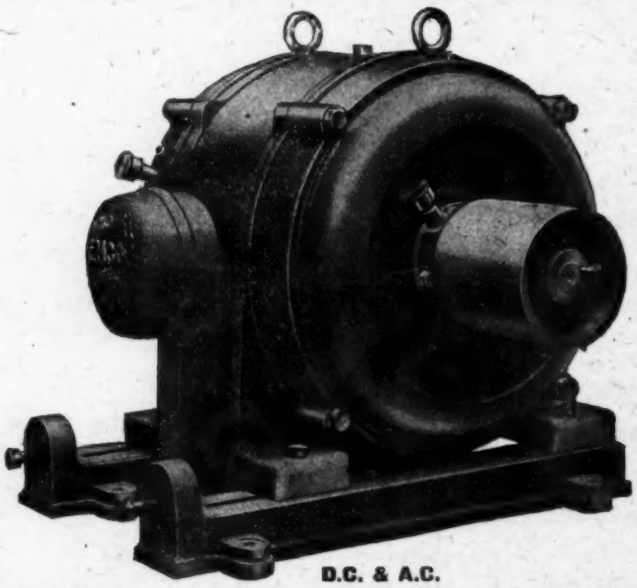

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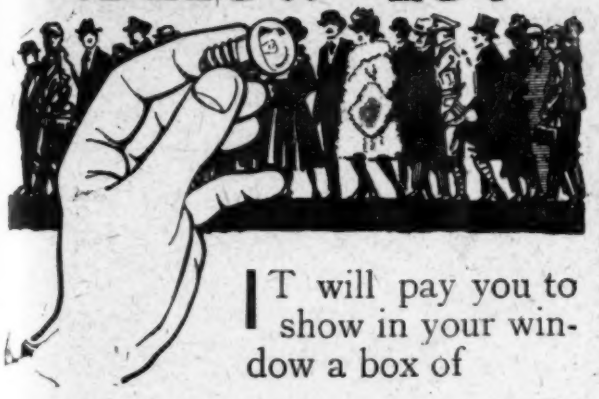

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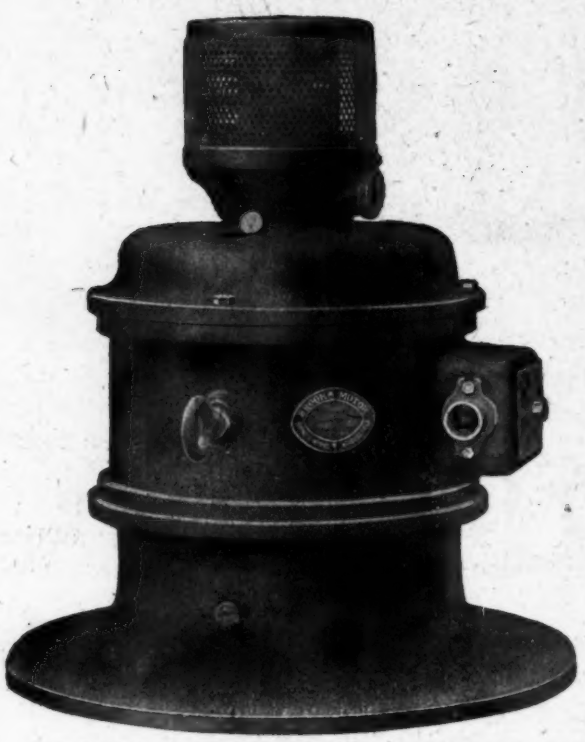

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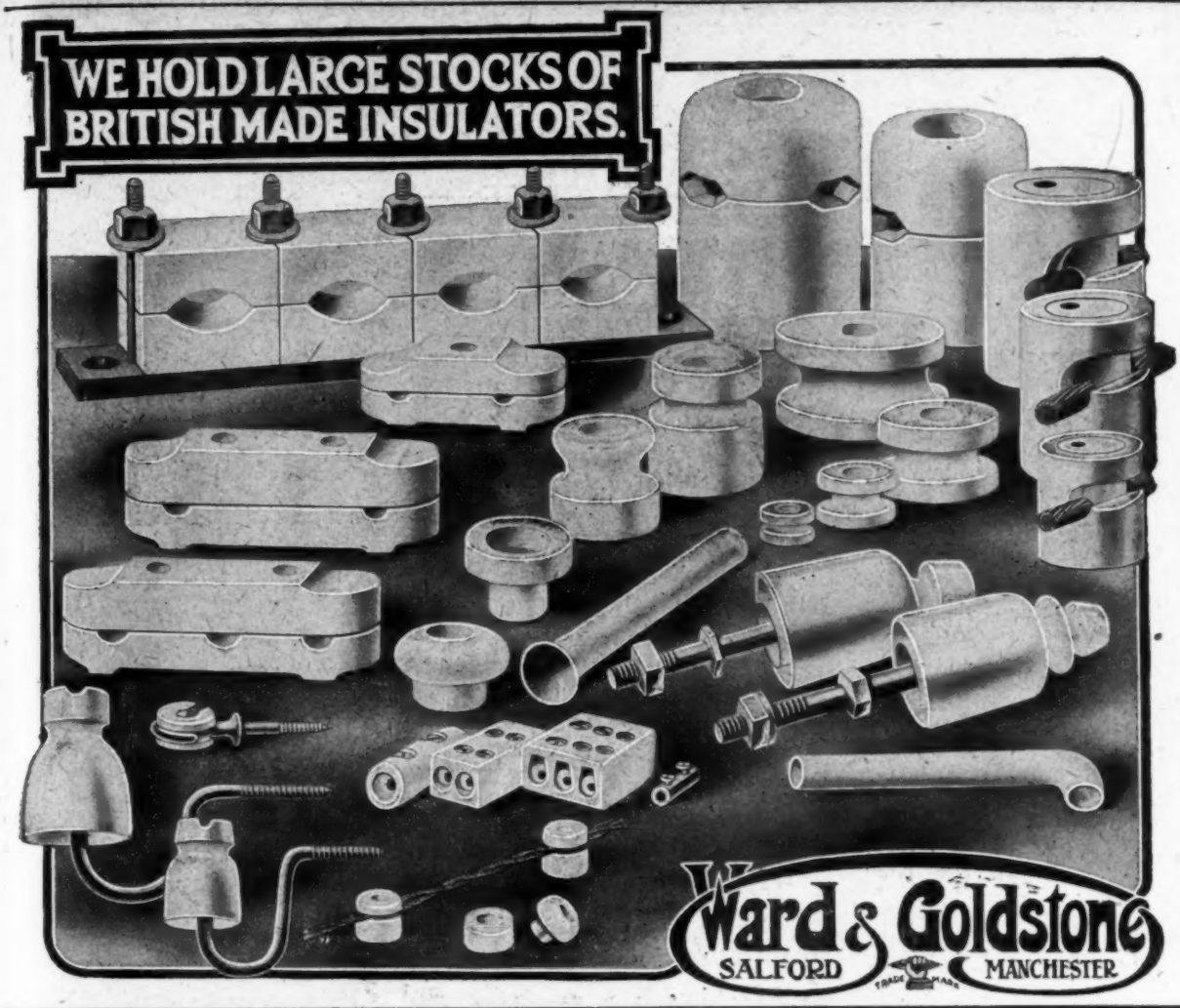
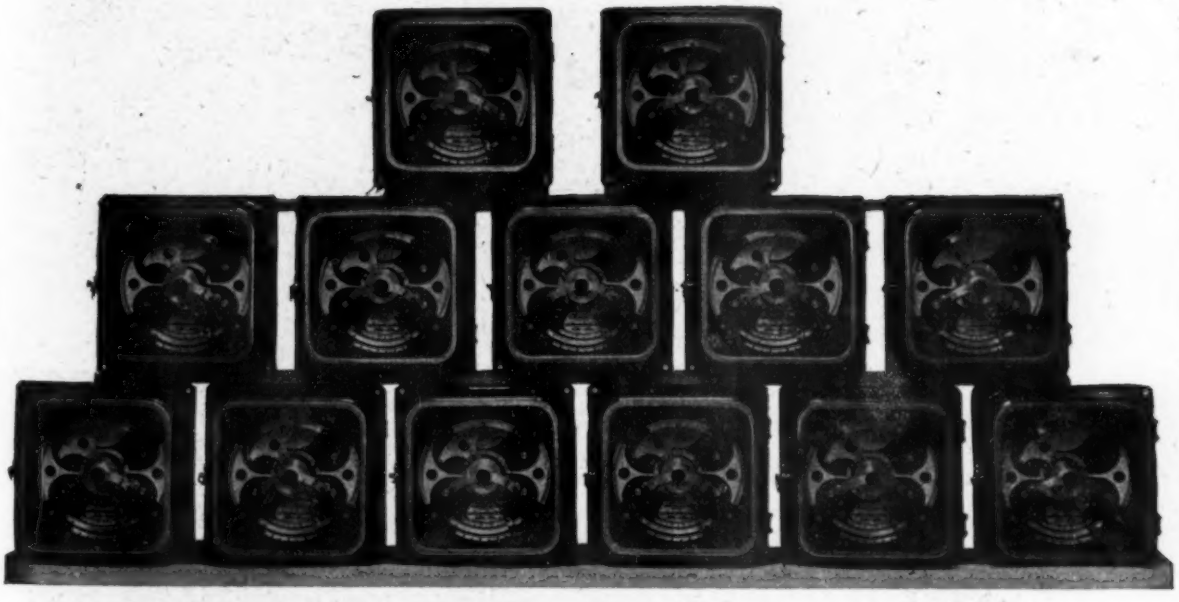


AUTOMATIC PRESSURE REGULATORS.



Part of an order for Automatic Pressure Regulator Equipments for the Victorian State Railways.

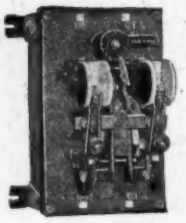
BROWN, BOVERI & CO., LIMITED, 9, OLD QUEEN ST., WESTMINSTER, S.W. 1

CONTROL

IGRANIC

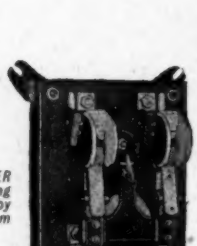
ELECTRIC

DEVICES



50-amp. CLAPPER SWITCH, latching type, for remote control of lighting or power circuits.

Push-Button Box, type 450-62 for the remote control of all kinds of Motors.



200-amp. CLAPPER SWITCH, latching type, operated by push-buttons from any distance.

Pressure Switch, type No. 450-47, automatically starts and stops compressor motors.

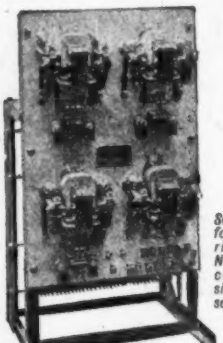
Automatic Control on Alternating Current systems provides maximum convenience.

Pumps, Fans, Compressors, Cranes, Capstans, Lifts and all kinds of Motor-driven Machines are as easily and safely controlled automatically on alternating current systems as on direct current.

Automatic control speeds production and protects men and machines.

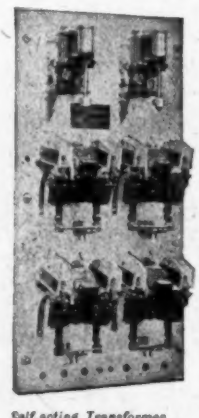
In steel works, machine shops, munition works, shipyards and railway shops all over the world "Igranic" Controllers are safeguarding and speeding-up motor-driven machinery.

Expert engineering advice on problems of control is offered free.

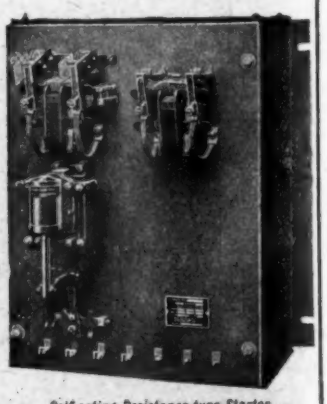


Self-acting Starter for polyphase slip-ring Motor, type No. 1080-1, for compressor or similar heavy duty service.

Float Switch, type No. 450-34, automatically starts and stops Pump Motors.



Self-acting Transformer type Starter for polyphase squirrel-cage motors, type No. 1040-1.



Self-acting Resistance type Starter, for polyphase squirrel-cage motors, type No. 1040-2.

IGRANIC ELECTRIC Co. LTD

147, Queen Victoria St., London.

30, Cross Street, MANCHESTER. *Works:* BEDFORD. 50, Wellington St., GLASGOW.

Printed by WILLIAM CATE, LTD., 147-150, Saffron Hill, E.C. 1, and Published by the Proprietors, H. ALABASTER, GATEHOUSE & KEMPE, 4, Ludgate Hill, London, E.C. 4.

LIGHTING AND POWER NOTES.

Birmingham.—Shorter Working Hours.—A proposal has been made with a view to economy of fuel and lighting in works in the Birmingham district that the pre-breakfast working time should be dispensed with. According to the *Engineer*, inquiries show that many manufacturers are entirely in favour of paying the same rate for a 50-hour week as is now paid for a 53-hour week, provided that an undertaking is given by the accredited representatives of the workpeople that the output of work shall be maintained.

Colne.—Price Increase.—The Corporation has decided to increase the charges for electricity for lighting from 5½d to 6d. per unit, and for power and traction by ½d. per unit, from October 1st last.

Continental.—Spain.—The following concessions for hydro-electric schemes have been sanctioned:—The use of 3,500 litres of water per second from the river Cubillas, at Ablote, Granada, for the generation of electricity, by Rafael Rubio Cabreriza; 1,200 litres per second from the Guadaloupe, at Alcariz (Ternil), by Miguel Diaz Gascon; 3,000 litres per second from the Quivios, at Fuente de la Vega, by the Sociedad Fabrica de Mieres, for the generation of electricity for use in the company's works.

Owing to the difficulty of importing coal, the Government has taken special measures for the utilisation of electricity. Committees of producers and consumers are to be formed in the principal districts to ascertain the amount generated, to superintend its equal distribution amongst industrial and other consumers, and to limit the hours of supply.

A new central generating station is being established at Palme de Mallorca for the supply of electricity throughout the island. The plant to be at first installed will comprise four 2,000-H.P. steam turbines and generators.

The Sociedad Productora de Fuerzas Motrices has been formed in Bilbao, with a capital of 6,400,000 pesetas, to build a generating station of 20,000-H.P. capacity, which will yield an estimated yearly output of 60,000,000 KW.-hrs., at Pobla de Segur (Lerida).

The Sociedad Fabrica de Meros has applied to the Government for a concession to utilise the water-power of the river Quiros, near Arroyo, for the generation of electricity.

Sweden.—Among the new electricity supply companies recently formed in Sweden are the Wemmenhog-Skytts Kraft Aktiebolag, organised at Skurup, with a maximum capital of £17,000, and the Karbole Elektriska Abtiebolag, formed at Karbole, with a maximum capital of £3,300.

Edinburgh.—Proposed Extensions.—At a meeting of the T.C., last week, it was stated that a shortage of electricity supply was being felt at Leith, and the Dock Commission was being seriously hampered in work of national importance. The T.C. is trying to obtain the support of the Leith T.C. and the Dock Commission to an application for sanction to proceed with the new power station at Portobello, and also to erect two new boilers at the McDonald Road station.

Grays.—Price Increase.—The U.D.C. has decided to increase the charges for electricity for lighting and power by a further 16⅔ per cent., a total increase on pre-war charges of 50 per cent., as from October 1st. The charge for public lighting is to be advanced by £100, and the minimum charges of 6s. 6d. per lamp per summer quarter and 13s. per winter quarter are to be adhered to.

Grimsby.—Price Increase.—The T.C. has decided to increase the price of electricity by 15 per cent.

Leeds.—Wages.—The General Purposes Committee has recommended the T.C. to increase the war bonus to all municipal workers by 5s. per week to men over 18 years of age, making a total bonus of 25s., and by 2s. to female employés, a total of 16s. per week.

Leek.—New Plant.—The U.D.C. has resolved that the scheme for the installation of new generating plant be carried out, and that application be made to the L.G.B. for sanction to a loan of £4,000.

Leyton.—Price Increase.—The E.L. Committee has recommended that the charges for private lighting and power be increased from 33⅓ per cent. to 50 per cent. over pre-war rates, and that the charge to the tramway department be increased from 10 per cent. to 50 per cent. over the average pre-war rate for the year, such increases to take effect from the commencement of the next Christmas quarter.

London.—Walthamstow.—Price Increase.—The E.L. Committee has recommended the following revised charges for electricity:—Lighting: Up to 750 units per quarter, 6d. per unit; for the second 750, 5½d.; above 1,500, 5d. Power: Up to 500 units per quarter, 2½d. per unit; second 500, 2¼d.; above 1,000, 1¾d.; from 30,000 to 150,000 per annum, 1¾d.; above 150,000, 1½d.; bioscope lanterns and public lighting, 3¼d. After the September quarter the special charges for arc lamps and metal-filament lamps are to be increased by 60 per cent. over pre-war rates. Supply by slot meter is to be increased on the same scale, plus the usual ½d. per unit meter rent and ¼d. per unit for free wiring installations.

Southwark.—Wages.—The B.C. has granted an increase of 3s. 6d. per week to employés in the electricity works, on the award of the Committee on Production.

Price Increases.—The Notting Hill E.L. Co. has advanced the price of electricity for lighting from 7d. to 8d. per unit, with a promise of a reduction if the revenue rises above the previous amount.

The Metropolitan Electric Supply Co., Ltd., has given notice that the charges for private lighting—5½d. per unit, trade lighting 5d. per unit, and power and heating 1½d. per unit—are subject to an increase of 40 per cent., as from the end of the present quarter.

Hackney.—Year's Working.—The annual accounts of the B.C. electricity department for the year ended March 31st last show that the revenue amounted to £102,078 and the expenditure to £57,742. Of the gross profit of £44,336, interest absorbed £14,268; loan repayment, £16,687; allowances to employés with the Forces, £1,825; £7,327 was placed to the relief of rates, and £3,586 to the reserve fund. During the year 19,063,540 units were generated and 668,464 purchased; 16,937,179 units were sold, as follows:—Private lighting, 1,713,520; power and factory lighting, 12,993,402; dust destructor, 123,344; public lighting, 137,546; and bulk supply, 1,969,367. The total cost per unit was ·8d., an increase of ·05d. compared with the preceding year, and the average price received was 1·42d. per unit against 1·33d. The load factor was 24·87 per cent., against 21·97, and the maximum demand was 7,775 KW. (A.C. 5,500, D.C. 2,275), against 7,951 (A.C. 5,900, D.C. 2,051). Compared with the previous year the expenditure increased by £7,264 and revenue by £14,114, net profit by £5,476, and units sold by 1,634,807.

Manchester.—Price Increase.—The E.L. Committee has recommended an increase from 30 to 40 per cent. over pre-war rates for electricity for lighting purposes. Small power consumers are to be charged an additional 15 per cent., and large consumers 7½ per cent. The advances are to come into force in December.

Oldham.—Price Increase.—The Electricity Committee has decided that the charges for electricity for lighting be increased by a further 20 per cent.; for power, heating, and cooking by 30 per cent.; cotton mills under agreement subject to a coal clause by 20 per cent.; and for traction purposes by 7½ per cent.

Lydney.—At a meeting of the District Council it was reported that the Government intended building 1,000 houses at Beachley, and that electric light would be laid on.

Peterborough.—Price Increase.—The Electricity Committee has decided on a further addition of 20 per cent. to the charges for electricity, making a total increase of 40 per cent.

Rotherham.—Price Increase.—The Corporation has given notice that the charges for electricity for power and heating purposes will be increased to 45 per cent. over pre-war charges from the September meter readings.

Salford.—Sale of Plant.—Subject to the sanction of the Ministry of Munitions, the Corporation has accepted the tender of the Blackburn Corporation for the purchase of a turbo-generator, at £2,500.

Shipley.—Price Increase.—The E.L. Committee has decided to advance the charges for electricity to power users not under agreement from 50 per cent. to 75 per cent. over pre-war rates.

Shrewsbury.—Price Increase.—The T.C. has been recommended by the E.L. Committee to increase the charges for electricity from 40 per cent. to 50 per cent. above pre-war charges.

Southport.—Electric Heating.—The Fuel Rationing Order has led to a large increase in the demand for electric radiators, of which there are now some 800 in use.

Spenborough.—E.L. Restrictions.—The Electricity Department has received instructions from the Ministry of Munitions to refuse applications for electricity for lighting and heating except in special circumstances, and under the Ministry's sanction, and to prohibit extensions to existing installations of motors without the permission of the Electricity Department.

Owing to urgently needed repairs, the supply was suspended between 8 a.m. and 2 p.m. on Sunday last.

Stafford.—Price Increase.—The Corporation has decided to increase the charges for electricity for lighting to 6½d. per unit, subject to the present rates of discount, and for power by 15 per cent.

West Bromwich.—Price Increase.—The E.C. recommends that for power purposes the price of electricity be advanced by ½d. per unit, with an additional sliding scale of 2 per cent. in respect of each 6d. per ton advance in the price of coal; and for lighting purposes a sliding scale of 2 per cent. in respect of advances in the price of coal.

Windsor.—Proposed Price Increase.—The Electrical Installation Co. has applied to the B. of T. for consent to increase the maximum charge for electricity from 8d. to 1s. per unit.

Worcester.—Water Power.—The E.L. Committee has recommended the T.C. to acquire the site of Bransford Mill, and the water rights of the Teine, in connection with the Powick generating station.

TRAMWAY AND RAILWAY NOTES.

Continental.—France.—Electrically-driven brushes are being used on the Orleans Railways, in France, for cleaning railway cabs and vehicles. Various forms of revolving brushes, driven at speeds of from 500 to 800 R.P.M. through flexible shafts by electric motors of ¼ to ½ H.P., are employed, the apparatus, as a whole, being slung, according to requirements, from various kinds of portable standards, with springs and counterweights.

Spain.—Fernando P. Casariego, of Orviedo, has applied for a concession to construct an electric tramway from Lavinna to La Felguera.

Formby.—Proposed Light Railway.—The B. of T. has confirmed the scheme of the L. & Y. Railway, passed by the Light Railway Commissioners, after an inquiry in 1915, authorising the construction of a light railway at Formby.

Glasgow.—Year's Working.—The annual accounts of the Corporation Tramways Department for the year ended May 31st, 1918, show that the revenue amounted to £1,412,635, compared with £1,260,115 in the previous year, and the expenditure to £1,044,183, against £838,065. Of the net revenue of £368,452, £11,119 was paid to the Paisley District Tramways Co., income-tax absorbed £64,405, £45,383 was placed to the depreciation fund, and £78,511 to the permanent way renewals fund, leaving a net balance of £177,552, against £160,984, which has been paid over to the common good of the city. The working expenditure account includes traffic expenses, £527,152 (or 4·818d. per car-mile); general expenses, £156,949 (1·435d. per car-mile); general repairs and maintenance, £179,811 (1·643d. per car-mile); power, £86,019 (·786d. per car mile, or ·503d. per unit); and allowances to dependents of employés with the Forces, £93,120. The total expenditure per car-mile was 9·543d., against 7·799d., and the income 12·9d., against 11·728d.; 99 miles of track were open for traffic; 26,261,231 car-miles were run, against 25,786,047; and 41,054,757 units were used for traction and car lighting, or 1·56 units per car-mile. The average number of cars in use was 685, the average number of miles travelled per day per car being 105; 40·5 per cent. of the receipts were from ½d. tickets, and 63·3 per cent. of the passengers carried were ½d. fares. During the year £16,479 was spent on capital account, and £7,681 on track renewals. Since June 1st, 1915, the department has been carrying its own employer's liability and workmen's compensation risks, and £4,335 has been transferred to this fund; £2,129 was paid out during the year in compensation, leaving a balance of £2,205. Ordinary repairs to the track amounted to £85,979, and repairs to the power plant to £8,815. The department now employs 2,273 women workers, including 290 drivers, 1,518 conductors, and 465 car washers. Of the 47,077,967 units generated, 46,433,970 were at 6,600 volts A.C., 487,187 at 550 volts D.C., 156,910 at 100 volts D.C., and, in addition, 1,712,980 units were supplied by the Electric Lighting Department. The maximum load on the power station was 17,100 KW., the load factor 32·6 per cent., and the coal consumption per unit 2·75 lb.

Halifax.—Tramcar Kitchens.—A Press correspondent has been informed that the National Kitchen tramcar in service at Halifax serves an average of 700 portions per day. The car is run on routes where a half-hourly passenger service is in vogue, and stops for 28 minutes at selected spots for the distribution of food; it then precedes the passenger-car until a loop is arrived at. To obviate this, it is hoped soon to have railless vehicles for the purpose. In spite of the extra cost, owing to the presence of the driver and conductor, and the cost of electricity for running the car, the venture pays its way.

Leeds.—Proposed Extensions.—The Tramways Committee has requested the Parliamentary Committee to obtain powers for the construction of a tramway through the Hawksworth Wood Estate, and from Dewsbury Road to the new Middleton town-planning site, and also for powers to run an omnibus service from Dewsbury Road and Hunslet to the same site.

Leeds—Bradford.—Parcel Carrying Service.—An arrangement has been completed for an inter-city service of parcel carrying by the Leeds and Bradford tramway undertakings, to commence at the beginning of November. The charges will vary from 4d. for 3 lb. and under, to 9d. for 56 lb. The Bradford parcel service, which has been in existence for many years, permits collection and delivery at any address within ½ mile of any line or terminus. The Leeds service was only recently established, and collection and delivery is limited to appointed agents on all the car routes.

London.—Accident.—By a collision on Saturday afternoon at Hammersmith between a motor lorry and a L.U.T. tramcar, the conductress and the drivers of the tramcar and lorry were injured, and had to be removed to hospital.

Musselburgh.—Novel Claim.—Mr. Andrew Clark, miners' agent for the Mid and East Lothian district of the Scottish Mine Workers' Association, is formulating a claim against the tramway company for loss of wages sustained by miners, who were prevented from getting to their work by a breakdown of the cars.

Stockton.—Proposed Purchase.—A special meeting of the T.C. is being held to consider the purchase of the tramway undertaking within the borough.

West Riding.—Service Reductions.—The Yorkshire (W.R.) Electric Tramways Co. has announced, as from Sept. 29th, a reduction of Sunday services between Wakefield and Leeds, Sandal, Ossett, Horbury, and Agbrigg, and between Leeds and Rothwell; a number of stopping places have also been discontinued.

United States.—The Skip-stop System.—The skip-stop, which means cutting out many needless stops of tramway cars, is rapidly being adopted in the U.S. The system has been advocated by the Fuel Administration as a means of saving fuel. It is estimated that 400,000 tons of fuel can thus be saved annually, also it means less wear and tear on brakes and equipment generally. Fewer starts and accelerations mean not only lower energy consumption per mile, but a reduction in time required to travel a given distance. The *Electrical Review*, Chicago, says:—"As a nation we have opposed the skip-stop, perhaps unthinkingly. But when we become accustomed to it, we like it. It is one of those measures instituted during the war because of the war—a fuel-saving measure—that will, we hope, stay when the war is won, because it relieves our utilities, makes them more efficient, improves city transportation, and conserves coal."

TELEGRAPH AND TELEPHONE NOTES.

American War Cables.—The Home Secretary has specially appointed Mr. F. H. Mitchell, C.B.E., to be responsible for the expeditious transmission through London of Press cables sent by the American correspondents with the American troops to their papers.—*The Times.*

Cable Mileage.—The total number of submarine cables owned and operated by private companies throughout the world is 412, with a mileage of 223,769 miles, and the cables owned by nations throughout the world are 2,140, with 48,990 miles, making a total of 2,552 cables with a mileage of 272,759 miles. At the present time, on account of the war, some of these cables are not operated.—*T. and T. Age.*

China.—According to the *Westminster Gazette*, what is believed to be the first direct wireless message from Europe ever received in China arrived on September 25th. The honour belongs to the new French Lyons wireless station, and the message was received at the French station at Shanghai in perfect order.

Direct Wireless to Australia.—Direct wireless communication between Great Britain and Australia was established on September 22nd, when two messages from the Premier (Mr. Hughes) and from Sir Joseph Cook were received by the Amalgamated Wireless Co. of Australasia from the new station at Carnarvon.

The messages were received at Sydney perfectly clear and distinct, despite direct transmission over 12,000 miles. They were confirmed verbatim by cable on the following day. Both of them appealed for reinforcements for the Australian battalions.

The previous record was made when Mr. Marconi at Buenos Ayres in 1910 received a message from Clifden, County Galway, 6,735 miles away. According to the *Daily Mail*, the managing director of the Amalgamated Wireless Co. in Sydney, who had been using a highly developed receiver, reported that he had picked up a message from Carnarvon, and asked that special messages should be sent to him as a test. The wireless communications from Mr. Hughes and Sir Joseph Cook were the result, and they went half round the world in a fourteenth of a second. At present the Australian instruments can receive, but cannot send, over so great a distance, but the experiment will undoubtedly lead to a direct service with Australia.

Spitzbergen.—The British expedition to Spitzbergen, in the Arctic Ocean, returned to England on Tuesday last.

Germany had a wireless installation on the island, set up by Prince Pless and Count Zeppelin in 1912, with direct communication to Berlin. The station has been destroyed, and the German wireless records have been brought back to England for examination.

CONTRACTS OPEN AND CLOSED.

OPEN.

Birkenhead.—October 10th. Electrical sundries, lamps and fittings, for the Mersey Railway Co. Mr. J. Shaw, General Manager & Secretary, Central Station.

Bedford.—November 13th. Two water-tube boilers, mechanical stokers, and induced-draught plant for the Corporation. See our advertisement pages to-day.

Manchester.—October 4th. Electricity Department. High and low-pressure steam and feed pipework, &c., at Stuart Street.

Portsmouth. — October 15th. Tramways Committee. Six months' supply of stores, including various electrical items. See "Official Notices" September 27th.

South Africa. — JOHANNESBURG. — November 27th. Municipal Council. 2,000 copper ribbon bonds, and 2,000 copper solid bonds (Contract No. 424). A copy of the specification can be seen at the Inquiry Office of the Department of Overseas Trade (Development and Intelligence), London.

Warrington.—October 22nd. Water-tube boiler, for the Electricity Department. See our advertisement pages to-day.

CLOSED.

Australia.—P.M.G.'s Department, N.S.W. :—

900 listening and ringing keys, £401.—Automatic Telephones (Aust.), Ltd.

P.M.G.'s Department, Queensland :—

Telephone material, schedule 436, £114.—Western Electric Co. (Aust.), Ltd.
Telephone material, schedule 436, £631.—James Paton & Co.

Victorian Railways :—

Voltmeters and charts, £149.—Australian General Electric Co.
—*Australian Industrial and Mining Standard.*

Leeds.—The E.C. has accepted the tender of Messrs. William Airey & Son, for excavating and concrete work, forming part of the building extensions at the electricity works, at £19,999.

Electricity Committee :—

Two-phase switchgear, £1,274, plus cost of erection.—Ferguson, Pailin & Co.
Three-phase switchgear, £6,300, switch cubicle, £540.—British Westinghouse E. & M. Co.
Centrifugal pump, £2,980.—Rees Roturbo Manufacturing Co.
Two boilers, with unit stoker, £33,998.—Babcock & Wilcox, Ltd.
6,000-kw. turbo-alternator and condensing plant, £39,196.—Richardsons, Westgarth & Co.

FORTHCOMING EVENTS.

Institution of Mechanical Engineers.—Friday, October 4th. At 6 p.m. At Great George Street, Westminster. Lecture on "The Experimental Study of the Mechanical Properties of Materials," by Dr. W. Cawthorne Unwin.
Friday, October 18th. At 6 p.m. At Great George Street, Westminster. General meeting.

Salford Technical and Engineering Association.—Saturday, October 5th. At 7 p.m. At the Royal Technical Institute. Paper on "Railway Electrification," by Mr. S. J. McCann.

Chief Technical Assistants' Association.—Saturday, October 5th. At 3 p.m. At Anderton's Hotel, Fleet Street, E.C. Paper on "Automatic Voltage Regulation," by Mr. Murdoch.

Institute of Marine Engineers (Inc.).—Tuesday, October 8th. At 6 p.m. At the Minories, Tower Hill, E.C. Paper on "Feeding and Circulating the Water in Steam Boilers," by Mr. J. Watson.

Industrial Reconstruction Council.—Tuesday, October 8th. At the Institute of Journalists, Tudor Street, E.C. At 6 p.m. Conference on "Interim Industrial Reconstruction Committees," introduced by Mr. W. Henderson-Pringle.

Electro-Harmonic Society.—Friday, October 11th. At 8 p.m. Smoking Concert. At the Holborn Restaurant, Venetian Chamber.

Birmingham and District Electric Club.—Saturday, October 12th. At the Swan Hotel, Birmingham. At 7 p.m. Paper on "Some Modern Applications of the Gyroscope," by Mr. H. F. Stevenson.

NOTES.

Engineering Wages.—The Committee on Production has increased the rates of pattern makers aged 21 and over, in the Birmingham and District engineering trade, by 2s. a week.

Electro-Harmonic Society.—The first smoking concert of the 1918-19 season is to be held on Friday next, October 11th, at the Holborn Restaurant (Venetian Chamber). It will commence at 8 p.m. The dates of other events for the season will be found in the ELECTRICAL REVIEW for August 2nd.

The artistes for next Friday are :—Mr. Richard Ripley, tenor ; Mr. Thomas Howell, baritone ; Mr. Olley Oakley, banjo ; Mr. Walter Weir, recitations ; Mr. George Ellis, humorist ; Mr. Finlay Dunn, entertainer at the piano ; Mr. Bernard Flanders, A.R.A.M., pianoforte solo and accompanist.

Fire Prevention.—The British Fire Prevention Committee has issued a "Warning" (free to the public) for householders, pointing out the precautions that should be observed in order to prevent outbreaks of fire, and the most effectual methods of dealing with them. Written inquiries regarding precautionary measures will be answered by the Committee, and copies of the leaflet can be obtained from its offices (8, Waterloo Place, S.W. 1), on application in writing, enclosing a stamped addressed envelope. Destruction of property by fire is, perhaps, the most wasteful and extravagant of the ills to which man is heir, and now that the heads of families are in so many cases absent from home on war service, it is highly desirable that those who remain in the household should omit no safeguard which may lessen the risk. The action of the Committee in distributing free expert advice on the subject is, therefore, most timely and commendable.

Volunteer Notes.—LONDON ARMY TROOPS COMPANIES, ROYAL ENGINEERS (V.).—Headquarters : Balderton Street, Oxford Street, W. 1.

Corps Orders No. 40, by Lieut.-Colonel C. B. Clay, V.D., Commanding.
Captain of the Week.—Capt. W. Hynam.
Next for Duty.—Capt. W. Darley Bentley.
Sunday, October 6th. — Annual Musketry course at Pirbright. Parade, Waterloo Station, 8.45 a.m. Drill order, rifles and side arms. Mid-day and tea rations to be carried.
Monday, October 7th to Saturday, October 12th.—Drills as usual.
Sunday, October 13th.—Commandant's Parade, at Waterloo Station, 8.45 a.m., for work at Esher. Drill order. Mid-day and tea rations to be carried
C. HIGGINS, *Capt.* R.E., *Adjutant.*

Patent Notice.—The proprietor of British Patent No. 21,881/14 ("machine for winding electromagnetic coils") is desirous of entering into an arrangement for the exploitation of the same. See our advertisement pages to-day.

Educational.—UNIVERSITY ENGINEERING COLLEGE.—We have received a leaflet drawing attention to the correspondence courses in engineering conducted by this Institution, which gives special attention to the Associate Membership Examinations of the engineering societies.

UNIVERSITY OF LONDON, UNIVERSITY COLLEGE.—A course of six lectures on "The Scientific Problems of Radiotelegraphy" will be delivered by Prof. J. A. Fleming, F.R.S., on Wednesdays, at 5 p.m., beginning October 30th, 1918. The course is open both to members and non-members of the University. Fee, £1 11s. 6d. Application for tickets of admission should be made to Dr. Walter W. Seton, M.A., University College, London (Gower Street, W.C. 1).

Mr. George Verity on the Outlook.—Mr. G. Verity presided over the annual prize distribution in connection with Charing Cross Medical School, and in an address to the students, said that the period following the conclusion of peace, if not carefully watched, might result in events such as were being seen in connection with the filthy horrors of Slavonic Bolshevism, but if guided aright, would result in material improvement in the condition of the people. It became the duty of professional men, and notably of the medical profession, to guide aright the forces with which they would be brought into contact.—*The Times.*

Industrial Profit-Sharing: Italian Government Decree.—Referring to the subject touched upon in our leading article last week, the *Times* correspondent in Rome says, under date of September 30th, that at the instance of the Ministry of Industry, Commerce, and Labour, a decree has been issued giving sanction to the principle of profit-sharing between masters and men. "Many industrial undertakings have formed a special reserve fund, after paying the limited dividends now allowed. The decree establishes that one-third of such reserve must be invested in State securities. The rest may form a special joint capital and labour distribution fund. No particular system is laid down, but the principle is established that the relations between Capital and Labour should be regulated on the base of fair sharing of profits, and power is given to individual undertakings to take measures for putting their profit-sharing systems into practice, each proposal being submitted to the Ministry for approval."

Sentence for Assault.—At the Rotherham Court on Monday last, Edward Brewster (23), miner, of Swinton, for assaulting a conductress and motorman on the Mexborough and Swinton Tramways system, was sent to gaol for three months on each assault, to run concurrently.

For Sale.—The Blackburn Corporation has for sale one 300-B.H.P. Bruce-Peebles motor, one 7½-B.H.P. Brush motor, and one 1·9-B.H.P. Westinghouse motor. See our advertisement pages to-day.

The British Engineers' Association.—ENGINEERING INVESTIGATION IN BRAZIL.—The Government, through the Department of Overseas Trade, is embarking upon another investigation abroad ; this time it has agreed to share the cost with the British Engineers' Association of an investigation into the prospects for the engineering industry in Brazil.

The investigator, whose name will be announced very shortly, will spend probably 12 months in Brazil, and his reports will cover the whole field open to engineering enterprise. In carrying out this investigation, we understand that the Council of the Association is not animated by any hostility towards the merchants and other existing channels through which engineering business has been carried on. It is desirous solely of obtaining for its members information of the requirements as to the Brazilian market, the openings for engineering plant and machinery, and particulars of the methods of doing business most likely to suit possible purchasers and users. It will be open to members who receive these reports to do business in any way they like. Some members of the Association are already established in Brazil with branch houses, others already do business through the merchanting and importing houses. Therefore, one result of this investigation should be to make manufacturers more willing to adapt their products and methods to local interests, and in this way this investigation should make it easier for merchants to supply their Brazilian demands from British sources.

The Price of Aluminium in 1919.—The Minister of Munitions announces that the control price of aluminium ingots of 98-99 per cent. purity will be reduced, as from January 1st, 1919 from £225 to £200 per ton, carriage paid to consumers' works The price of remelted aluminium scrap and swarf ingots will remain as at present.

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OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station and Tramway Officials.—Mr. McCullough, on resigning the managership of the tramways at Carlisle, has been presented by the staff with a piece of silver plate.

Blackburn Town Council, in Committee, has unanimously approved the Electricity Committee's recommendation to grant a sum of £500 to Mr. P. P. Wheelwright, borough electrical engineer, in respect of the extra duties performed in connection with special work on which a large profit was made.

Mr. J. W. Warr, deputy electrical engineer to the St. Helens Corporation, has been appointed chief mechanical engineer to the United Glass Bottle Manufacturers, Ltd.

The employés of the Belfast electricity department have presented Mr. Parker, chief clerk, with a cutlery canteen and a cheque, on the occasion of his marriage. Councillor Duff, vice-chairman of the Electricity Committee, presided, and Mr. Bloxam, chief electrical engineer, made the presentation.

Heston-Isleworth District Council has appointed Mr. E. Broad, senior engineer at the electricity works, to be assistant station superintendent, at £270 per annum.

Mr. J. E. Edgecombe, borough electrical engineer of Kingston-upon-Thames, has been appointed director of the Tungsten Lamp Association. The Corporation of Kingston-upon-Thames has voted him the sum of £500 for his special work in connection with the extension of the power station. Mr. Edgecombe's chief assistant, Mr. T. A. Kingham, has been appointed acting borough electrical engineer, at a salary of £400 per annum.

Mr. H. L. Cottam, borough electrical engineer, has been appointed by the Controller of Coal Mines to act as District Engineer in the Horsham area in connection with the Coal Economy Campaign.

Mr. J. K. Brydges, borough electrical engineer, Eastbourne, has been appointed by the Controller of Coal Mines to act as District Engineer in connection with the Coal Economy Campaign.

A proposal to advance the salary of Mr. P. W. L. Phillips, borough electrical engineer at Bedford, from £400 to £500, is to be further considered. The proposal followed upon an application from Mr. Phillips, who is serving in the R.A.F., that the amount of his salary be raised to the figure which it might have been expected to have reached had he been carrying on his duties when the recent increases to borough officials took place.

General.—Mr. E. Pelham Bennett, London and South of England manager for Simplex Conduits, Ltd., and formerly the company's manager in Liverpool, has been appointed to the Royal Air Force, Air Construction Service.

Councillor D. Hayward, chairman of the Electricity Committee, has accepted the mayoralty of Walsall.

Lieut. W. P. Durtnall, R.N.V.R., has been granted a temporary commission as Staff-Captain in the R.A.F., and is engaged in the Technical Department of the Chief Electrical Engineer of the Air Ministry.

The Minister of Munitions has appointed Mr. A. E. Berriman, chief engineer to the Daimler Co., to be Deputy-Controller of the Technical Department of the Department of Aircraft Production of the Ministry, in succession to the late Prof. Bertram Hopkinson, F.R.S.

Roll of Honour.—Dispatch Rider Samuel Heighes, who was employed by Messrs. Cunningham, Ltd., London, was killed in France during an air raid.

Private G. A. Henderson, Manchester Regiment, who has died of wounds, was employed by Messrs. Baxendale & Co., Ltd.

Private F. Shutler, Loyal North Lancashire Regiment, who has been killed, was employed by the British Westinghouse Co., Ltd., Trafford Park.

Corporal David Hunter, H.L.I., one of the heroes of Mœuvres, whose praise has rung throughout the country since Sir Douglas Haig referred to the gallant stand made by the corporal and six men when surrounded by the enemy, is a native of the mining village of Kingseat, Dunfermline, and a son of an employé at the Fife Electric Co.'s generating station at Townhill.

Corporal C. Brailsford, R.F.A., who was on the electricity staff at Grassmoor Colliery, Chesterfield, has been wounded for the third time.

Driver J. N. Lloyd, R.F.A., late of the electrical engineering department of the Scarborough Electric Supply Co., Ltd., has gained the Military Medal.

Private J. W. Wild, Manchester Regiment, killed in action, was employed by Messrs. Baxendale & Co., Ltd.

Sapper R. Barry, R.E., killed in a train accident in France, was employed by the British Westinghouse Co., Ltd., Trafford Park.

The Military Medal, for bravery and devotion to duty, has been awarded to Sergeant E. L. Lane, R.G.A., who has been four times mentioned in dispatches. The award was made in recognition of his services in leading 100 men through a difficult situation. He was formerly employed at the Dukinfield electric generating station.

Private O. Hansom, Welsh Regiment, who has been killed in action, aged 19, was the eldest son of Mr. Oswin Hansom, engineer and manager of the Liverpool District Lighting Co.

Second-Lieut. A. V. Shillcock, Royal Berkshire Regiment, of Handsworth, Birmingham (formerly a member of the staff of the General Electric Co.) has been awarded a bar to his Military Cross.

Gunner J. F. Chater, Warwickshire R.G.A., who has been killed in action, was employed at the electric supply station, Summer Lane, Birmingham.

Private G. Crosland, Manchester Regiment, killed in action, was an employé of the B.I. & Helsby Cables, Ltd., of which firm his father, the late Mr. Joseph Crosland, was works manager.

Private W. Cleworth, K.O. Royal Lancaster Regiment, killed in action, was employed by Messrs. Connolly Bros., Ltd., Blackley, Manchester.

The death in action is announced of Private H. Lees (38), Royal Warwickshire Regiment, formerly an employé of the General Electric Co., Ltd., Witton.

Second-Lieut. W. Hayes, one of Messrs. Falk, Stadelmann's Manchester representatives, has been killed in action in France.

Rifleman E. T. S. Morris (London Irish) has been killed in action, and Private R. W. Dennis (W. Yorks. Regiment) wounded. Both were formerly in the General Office of the India Rubber Co., Silvertown, E.

Obituary.—The *Australian Industrial and Mining Standard* states that Mr. William Warren, for many years superintendent and general manager in Australia of the Eastern Extension Telegraph Co., died in Sydney, early in July, at the age of 82 years, closing a career which had been practically throughout associated with telegraphic communication. "Mr. Warren was one of the party which laid the first cable between Suez and Bombay. When his company secured the concession to lay the first cable across Bass Strait from Low Head, Tasmania, to Flinders, Mr. Warren was sent out to do the work and to become manager. When the Eastern Extension Telegraph Co. bought out the Telegraph Construction Co. and established the connection between Banjoewangie (Java) and Port Darwin, Mr. Warren became their chief representative in Australia, and retained that position until a few years ago, when he retired upon pension."

The *Times* "Killed in Action" column states that the death occurred on September 20th, at Penmaenmawr, of Thomas Davies, A.M.I.C.E., A.M.I.E.E., late Lieutenant R.E., Codsall, Staffs., aged 36 years.

AN AUTOMATIC SPACING AND PUNCHING MACHINE.

An article by S. A. Hand in the *American Machinist*, September 17th, describes a very novel and ingenious machine for automatically spacing and punching structural steel. All motions are electrically controlled from a central keyboard in much the same manner as musical instruments are played. This machine, which was designed and built under the supervision of Edward V. Wurts, chief engineer, Steel Utilities, Inc., Newark, N.J., automatically spaces and punches variable structural members in both web and flange in one passage through the machine, and in any lengths and widths up to the maximum delivered by the rolling mills. Any number of beams varying in size, length, number, and arrangement of holes may be punched expeditiously as a like number of beams which are exactly similar in every respect. This will allow material to be punched and shipped as the progress of the work demands instead of having to punch all of one size and pattern while the machine is set, which often means sorting out, shipping part, and storing part to be rehandled for later shipment.

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OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station and Tramway Officials.—Mr. McCullough, on resigning the managership of the tramways at Carlisle, has been presented by the staff with a piece of silver plate.

Blackburn Town Council, in Committee, has unanimously approved the Electricity Committee's recommendation to grant a sum of £500 to Mr. P. P. Wheelwright, borough electrical engineer, in respect of the extra duties performed in connection with special work on which a large profit was made.

Mr. J. W. Warr, deputy electrical engineer to the St. Helens Corporation, has been appointed chief mechanical engineer to the United Glass Bottle Manufacturers, Ltd.

The employés of the Belfast electricity department have presented Mr. Parker, chief clerk, with a cutlery canteen and a cheque, on the occasion of his marriage. Councillor Duff, vice-chairman of the Electricity Committee, presided, and Mr. Bloxam, chief electrical engineer, made the presentation.

Heston-Isleworth District Council has appointed Mr. E. Broad, senior engineer at the electricity works, to be assistant station superintendent, at £270 per annum.

Mr. J. E. Edgecombe, borough electrical engineer of Kingston-upon-Thames, has been appointed director of the Tungsten Lamp Association. The Corporation of Kingston-upon-Thames has voted him the sum of £500 for his special work in connection with the extension of the power station. Mr. Edgecombe's chief assistant, Mr. T. A. Kingham, has been appointed acting borough electrical engineer, at a salary of £400 per annum.

Mr. H. L. Cottam, borough electrical engineer, has been appointed by the Controller of Coal Mines to act as District Engineer in the Horsham area in connection with the Coal Economy Campaign.

Mr. J. K. Brydges, borough electrical engineer, Eastbourne, has been appointed by the Controller of Coal Mines to act as District Engineer in connection with the Coal Economy Campaign.

A proposal to advance the salary of Mr. P. W. L. Phillips, borough electrical engineer at Bedford, from £400 to £500, is to be further considered. The proposal followed upon an application from Mr. Phillips, who is serving in the R.A.F., that the amount of his salary be raised to the figure which it might have been expected to have reached had he been carrying on his duties when the recent increases to borough officials took place.

General.—Mr. E. Pelham Bennett, London and South of England manager for Simplex Conduits, Ltd., and formerly the company's manager in Liverpool, has been appointed to the Royal Air Force, Air Construction Service.

Councillor D. Hayward, chairman of the Electricity Committee, has accepted the mayoralty of Walsall.

Lieut. W. P. Durtnall, R.N.V.R., has been granted a temporary commission as Staff-Captain in the R.A.F., and is engaged in the Technical Department of the Chief Electrical Engineer of the Air Ministry.

The Minister of Munitions has appointed Mr. A. E. Berriman, chief engineer to the Daimler Co., to be Deputy-Controller of the Technical Department of the Department of Aircraft Production of the Ministry, in succession to the late Prof. Bertram Hopkinson, F.R.S.

Roll of Honour.—Dispatch Rider Samuel Heighes, who was employed by Messrs. Cunningham, Ltd., London, was killed in France during an air raid.

Private G. A. Henderson, Manchester Regiment, who has died of wounds, was employed by Messrs. Baxendale & Co., Ltd.

Private F. Shutler, Loyal North Lancashire Regiment, who has been killed, was employed by the British Westinghouse Co., Ltd., Trafford Park.

Corporal David Hunter, H.L.I., one of the heroes of Mœuvres, whose praise has rung throughout the country since Sir Douglas Haig referred to the gallant stand made by the corporal and six men when surrounded by the enemy, is a native of the mining village of Kingseat, Dunfermline, and a son of an employé at the Fife Electric Co.'s generating station at Townhill.

Corporal C. Brailsford, R.F.A., who was on the electricity staff at Grassmoor Colliery, Chesterfield, has been wounded for the third time.

Driver J. N. Lloyd, R.F.A., late of the electrical engineering department of the Scarborough Electric Supply Co., Ltd., has gained the Military Medal.

Private J. W. Wild, Manchester Regiment, killed in action, was employed by Messrs. Baxendale & Co., Ltd.

Sapper R. Barry, R.E., killed in a train accident in France, was employed by the British Westinghouse Co., Ltd., Trafford Park.

The Military Medal, for bravery and devotion to duty, has been awarded to Sergeant E. L. Lane, R.G.A., who has been four times mentioned in dispatches. The award was made in recognition of his services in leading 100 men through a difficult situation. He was formerly employed at the Dukinfield electric generating station.

Private O. Hansom, Welsh Regiment, who has been killed in action, aged 19, was the eldest son of Mr. Oswin Hansom, engineer and manager of the Liverpool District Lighting Co.

Second-Lieut. A. V. Shillcock, Royal Berkshire Regiment, of Handsworth, Birmingham (formerly a member of the staff of the General Electric Co.) has been awarded a bar to his Military Cross.

Gunner J. F. Chater, Warwickshire R.G.A., who has been killed in action, was employed at the electric supply station, Summer Lane, Birmingham.

Private G. Crosland, Manchester Regiment, killed in action, was an employé of the B.I. & Helsby Cables, Ltd., of which firm his father, the late Mr. Joseph Crosland, was works manager.

Private W. Cleworth, K.O. Royal Lancaster Regiment, killed in action, was employed by Messrs. Connolly Bros., Ltd., Blackley, Manchester.

The death in action is announced of Private H. Lees (38), Royal Warwickshire Regiment, formerly an employé of the General Electric Co., Ltd., Witton.

Second-Lieut. W. Hayes, one of Messrs. Falk, Stadelmann's Manchester representatives, has been killed in action in France.

Rifleman E. T. S. Morris (London Irish) has been killed in action, and Private R. W. Dennis (W. Yorks. Regiment) wounded. Both were formerly in the General Office of the India Rubber Co., Silvertown, E.

Obituary.—The *Australian Industrial and Mining Standard* states that Mr. William Warren, for many years superintendent and general manager in Australia of the Eastern Extension Telegraph Co., died in Sydney, early in July, at the age of 82 years, closing a career which had been practically throughout associated with telegraphic communication. "Mr. Warren was one of the party which laid the first cable between Suez and Bombay. When his company secured the concession to lay the first cable across Bass Strait from Low Head, Tasmania, to Flinders, Mr. Warren was sent out to do the work and to become manager. When the Eastern Extension Telegraph Co. bought out the Telegraph Construction Co. and established the connection between Banjoewangie (Java) and Port Darwin, Mr. Warren became their chief representative in Australia, and retained that position until a few years ago, when he retired upon pension."

The *Times* "Killed in Action" column states that the death occurred on September 20th, at Penmaenmawr, of Thomas Davies, A.M.I.C.E., A.M.I.E.E., late Lieutenant R.E., Codsall, Staffs., aged 36 years.

AN AUTOMATIC SPACING AND PUNCHING MACHINE.

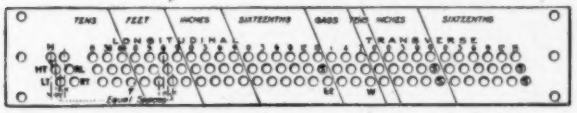
An article by S. A. Hand in the *American Machinist*, September 17th, describes a very novel and ingenious machine for automatically spacing and punching structural steel. All motions are electrically controlled from a central keyboard in much the same manner as musical instruments are played. This machine, which was designed and built under the supervision of Edward V. Wurts, chief engineer, Steel Utilities, Inc., Newark, N.J., automatically spaces and punches variable structural members in both web and flange in one passage through the machine, and in any lengths and widths up to the maximum delivered by the rolling mills. Any number of beams varying in size, length, number, and arrangement of holes may be punched expeditiously as a like number of beams which are exactly similar in every respect. This will allow material to be punched and shipped as the progress of the work demands instead of having to punch all of one size and pattern while the machine is set, which often means sorting out, shipping part, and storing part to be rehandled for later shipment.

One man operates the machine by placing the work on the

entering table from a storage bed and discharging it from the delivery table to a loading or runout table. The labour and cost of making templets and of laying out work is eliminated; detail drawings, tracings, and blueprints are not required. The record sheets used in the machine are made up in much less time than is required for making the usual detail sheets. The method of making the record sheet practically excludes error, and with the safety devices prevents punching the work, except as indicated, and ensures against all annoyances of lost time and back charges so frequently encountered through incorrectly punched work.

The equipment consists of two punches—a flange punch for punching one or two holes in either or both flanges of a beam or channel, and a web punch for punching from one to four holes in the web. Motor-driven roller tables on entering and delivery sides move the work to and from the punches, which are set in tandem. The longitudinal travel of the beam is regulated by a distance control, which automatically advances and stops the beam in correct position relative to either punch. The transverse spacing is accomplished by a transverse control connected to the web punch, which automatically traverses the punch head across the beam, stopping in position for punching.

In operating the machine the record sheet is placed in the keyboard; the beam or other work to be punched is placed on the entering table and the operator closes the starting switch. The beam progresses through the machine, stops in position for punching, is punched, again advanced, stopped



W = Web punch; F = Flange punch; L2 = Readings in same inch longitudinal-set in previous reading; LT = Readings in same inch transverse; H = Hold same foot-longitudinal; RL = Repeats longitudinal setting; RT = Repeats transverse setting; GAGS = No. 1 to 4 web punch and No. 5 to 8 flange punch; HT = Holds transverse; S = Separator adjustment.

FIG. 1.—GUIDE PLATE FOR PUNCHING RECORD SHEETS.

and punched, and so on until all the holes in web and flange have been punched and the beam delivered on the loading table. The operator then resets the machine, removes the record sheet and inserts a new one, or the same one again, and when the next beam is placed on the entering table the machine is ready to be again started.

The controls are operated from the keyboard, in which electrical contacts are made through the perforations in the record sheet. The stop motions of the punches are controlled from the record sheet and electrically interlocked with the table motor circuit and both control motor circuits, so that the punch cannot operate until the work is at rest. The spacing distances must have been fully run out before the punches can start, and any failure of the apparatus holds up punching, making it impossible to punch a hole otherwise than is indicated in the record sheet. All punches are provided with gags set from the record sheet.

When the beam approaches punching position a slowdown device makes electrical contact, slowing down the tables. At slow speed the beam meets a set stop, arresting its travel, the motor circuits are opened, and the punch circuits are closed, starting the punches indicated by the record sheet. The return stroke of the punch operates a switch to reset the apparatus, advances the record sheet for a new setting and starts the table motors, when the cycle is repeated. The punch operates only when all three motors have stopped, and the table motors start automatically on the return of the punch.

The record sheet is a perforated card prepared in advance for each beam or length of work. The perforations denote tens of feet, units of feet, inches and sixteenths of an inch for longitudinal movement, and tens of inches, inches and sixteenths of an inch for transverse movement, web punching, flange punching, punch gags, punch spacing, and repeat and hold for both longitudinal and transverse movements. Electrical contacts are made through the perforations in the sheet. The location of the hole determines the particular contact to be made and therefore the operation to be performed.

The keyboard has two opposed sets of small plungers or contact points which, through the perforations in the record sheet, energise the corresponding relays and contactors on the automatic switchboard to set and control the movements of the machine for punching one hole or group of holes. The upper contacts are connected to a common feed wire carrying 30 volts D.C. The lower contacts connect individually to their respective relays on the switchboard. When the record sheet is inserted the upper keyboard is brought to a horizontal position and latched to the stem of a solenoid. The upper keyboard lifts slightly after each punching operation, and the record sheet feeds forward to bring a new set of perforations between the contact points for the next operation. The feed mechanism also opens the circuit while the record sheet is advancing and closes it when the sheet is in position. The keyboard feed is driven from a small motor through a friction drive, but may be driven from the main shaft of the punch.

The automatic switchboard mounts the relays and contactors for the control of the machine. For longitudinal distance control, groups of relays for tens of feet and feet energise the selected foot segment, limiting the feet of longitudinal travel.

Groups of relays for inches and sixteenths of an inch connect to the respective stop-pin solenoids and set the stop pins selected by the record sheet. Similar groups for the transverse control are for tens of inches, inches, and sixteenths of an inch. The first two groups in combination energise the slowdown and stop contacts for the designated inch, and the last group sets the stop pins. The gags, punch-adjustment, and punch-starting relays are all set from the record sheet, but the final closing of the punch-starting circuits is through a relay set from the stop circuit. Contactors for motor control automatically give fast or slow speed for forward or reverse movement of table, longitudinal distance control, transverse distance control, and adjustment motors. A system of electrical interlocks on contactors holds up punching until both longitudinal and transverse distances have been completed, and arrests punching and stops the machine in the event of failure of any part.

The motor circuits and stop-pin solenoid circuits are all 230 volts D.C. The control circuits for keyboard-operated relays and slow and stop contacts are 30 volts D.C. from a ½-KW., 230- to 30-volt motor-generator set. The various switches are used for hand control and are grouped on a board conveniently placed for the operator. The automatic switchboard may be located in any desired position where it can be properly housed and protected, it was designed for standard equipment which was furnished by the General Electric Co., which also supplied the motors.

The feed tables on the entering and delivery sides of the punches are motor-driven roller tables of the familiar rolling-mill type. The work may be run on the entering table from the end or may be pushed or pulled on at the side in the usual way. A kick-off in the line of the delivery table places the punched work on skids for loading, or transfers it to a runout table to be conveyed to the loading point.

The longitudinal distance control, or spacing, mechanism comprises the foot-measuring devices and the mechanism for measuring inches and sixteenths. The foot-measuring devices consist of a carriage sliding on fixed guide rails at one side of the delivery table; a heavy screw under the carriage and between the guide rails; a motor drive for the screw and a series of foot segments or electrical contacts placed one foot apart on an insulating bar parallel to and above the guide rails. These foot segments are energised from the record sheet. The work, driven ahead by the rotation of the table rollers, pushes the carriage in advance along the guide bars. The carriage is provided with a latch which is electrically dropped into engagement with the thread of the screw at any even foot. The dropping of this latch controlled by the record sheet arrests the travel of the carriage at the particular foot desired. The carriage thus forms a stop for the work, permitting it to travel up to the desired foot, as determined by the record sheet.

Two copper shoes are supported on the carriage to slide under the foot segments, one in advance of the other. The carriage also has three trolleys, with wires stretched along the table. The leading shoe and one of the trolleys have the function of slowing down the table motor when the live foot segment is reached. The other shoe and two remaining trolleys make connections which set the latch and close the circuit for the contactors starting the longitudinal control motor.

Inches and sixteenths of an inch are measured by a rotation of the screw, which permits a farther advance of the carriage and work after the latch has been set in engagement with the screw.

The screw is driven by the control motor through a friction clutch. The inch-measuring disk is geared to the screw so that while the screw makes three revolutions per foot of carriage travel the inch disk makes one revolution. The inch disk has a slot on one side extending through eleven-twelfths of its circumference, equivalent to 11 in. of carriage travel. Opposite this slot, but supported in the sixteenths disk (which is sleeved on the same shaft with the inch disk), are 12 equally-spaced stop pins, any one of which may be projected into the slot to limit the inches of carriage travel. The stop pins are set by solenoids, through relays, from the record sheet, and are spring retracted when the solenoids are de-energised. The set inch stop pin allows a rotation of the screw until the pin engages the end of the slot. The carriage and work have then travelled the designated number of inches, the work being still driven at slow speed against the carriage. The sixteenths stop pins, identical in construction and operation with the inch pins, are carried in a fixed housing. In the sixteenths disk, opposite the pins, is a series of sixteen slots of different length, one for each pin, to permit rotation of the sixteenths disk corresponding to the recorded sixteenths of carriage travel. When the set inch pin has engaged the end of the inch slot the sixteenths disk, carrying the inch pins and the sixteenths slots, begins to revolve with the inch disk and the screw, and so continues until finally arrested by the set sixteenths stop pin. This stops the movement of the carriage and the work at the desired foot, inch and sixteenth of an inch of carriage travel, as indicated on the record sheet.

The friction drive allows the motor to drift to rest without jar. When the stop pins are released the sixteenths disk is returned to the initial position by its counterweight. A jaw

clutch connects the screw shaft and the pinion driving the inch gear and disk. When the clutch is open the screw may be rotated independently of the inch disk, and by reversal of the motor the carriage may be returned to its initial position. The clutch is controlled by a solenoid operated from the switchboard. Slowdown contacts for the motors are spaced around the circumference of a fixed disk next to the inch disk, and are operated by a cam on the web of the gear.

The sixteenths and inch mechanisms return to zero position after every setting except when held in position by a keyboard contact, when the next setting advances in the same inch or foot of travel respectively.

If an inch or sixteenths stop pin should fail to engage its slot or the latch fail to engage the screw, or if the latch or stop pin should fail to release, electrical interlocks will prevent the punches from operating, the machine will stop and wait to be reset, and indicating lamps will light up to show the defective circuit.

The transverse distance control governs the travel of the web punch across the work.

The web punch is a heavy, double-frame punch of special design, motor driven, with a stop-motion clutch electrically controlled from the record sheet. When the spacing movement is completed the punch starts, and, after punching, again starts the spacing apparatus for the next hole or group of holes. It will punch up to four 1-in. holes in 1-in. material.

The distance between the pairs of punches and dies is adjustable and controlled from the record sheet. This adjustment is similar to that of the distance controls. The two pairs of punches are also moved as a unit. The punches are made selective by gags set from the record sheet.

The flange punch is a heavy horizontal power punch specially designed to co-operate with the feed tables and spacing mechanisms. It is motor driven and provided with an electrically controlled stop motion similar to that on the web punch. The machine will punch up to 2½-in. holes in either or both flanges of a beam, or one 1-in. hole in either or both flanges of a channel. Gags for the punches are set from the record sheet. The machine is set by hand or power for the size of the beam.

The flange punch co-operates with the spacing mechanism in the same manner as described for the web punch. Web punching or flange punching, or both, takes place, as determined by the record sheet.

The spacing apparatus, with the keyboard and automatic switchboard, has been operated during the past two years by

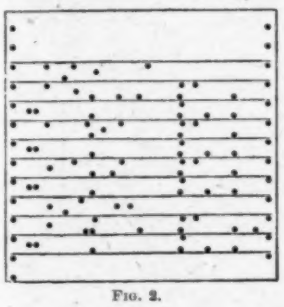


Fig. 2.

Fig. 3.

Fig. 2.—Record Sheet.

Fig. 3.—Beam 12 in. × 17 ft. Automatically Punched.

Steel Utilites, Inc., of Newark, N.J., demonstrating the speed and accuracy of the spacing and the reliability of the machine.

The following results are from a recent run of the machine: Duration of run, 8 hours; number of beams handled, 151; lineal feet of beam handled, 2,471; number of spacings made, 3,070; number of holes dummy punched, 5,073. Thirteen record sheets were used in rotation for beams from 12 to 17 ft. long, with an average length of 16 ft. 4 in. Longitudinal spacing varied from 15 ft. to 1/16 in., with an average of 9½ in. The transverse spacings were from 15 in. to 1/16 in. with an average of 3 in. One man operated the machine. Fig. 1 shows the plate for guiding the punch in punching the record sheet; fig. 2 represents the record sheet, and fig. 3 is an outline drawing of a beam automatically punched with the punches and spacing mechanism controlled by the record sheet, fig. 2.

NEW COMPANIES REGISTERED.

Chain Elevators, Ltd. (151,486).—Private company. Registered September 21st. Capital, £30,000 in £1 shares. To carry on the business of manufacturers of and dealers in devices for raising and promoting the circulation or carriage of liquids and fluids, pump manufacturers, electrical and general engineers, steel makers, shipwrights. Agreement with J. C. Grant and A. Jarvis. The subscribers (each with one share) are:—D. B. Callow, 28a, Davenport Road, Catford, S.E. 6, secretary; E. K. Mizen, 22, Lancaster Road, Stroud Green, N. 4, engineer. The directors are to be appointed by the subscribers. Solicitor: F. S. Clark, 53, Cannon Street, E.C.

Photector Co., Ltd. (151,497).—Private company. Registered September 23rd. Capital, £2,000 in 1,900 ord. shares of £1 each and 2,000 founders' shares of 1s. each. Mechanical, technical, commercial, electrical, or general engineers, technical advisers, consulting engineers, tool, mould, and castings manufacturers, metal workers, chemists, metallurgists, owners of patents, &c. Agreement with Justus Eck. The subscribers (each with one founder's share) are:—Justus Eck, 10, Priory Road, Chiswick, W. 4, engineer; F. Sawyer, Charlbury, London Road, Norbury, S.W. 16, solicitor's clerk. Justus Eck is one of the first directors, and may retain office while holding 1,000 shares of any class. Sergius Brook, of 13, Grange Road, Gunnersbury, may, while holding 600 shares of any class, appoint any person approved by the board as a director.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

La Plata Electric Tramways Co., Ltd.—Supplemental trust deed dated September 17th, 1918, to secure interest at 5 per cent. per annum on the arrears of interest accruing prior to January 1st, 1920, and on the instalment of interest due July 1st, 1918, on the first mortgage debenture stock outstanding. (The amount of said debenture stock outstanding is £100,450, and same carries interest at 5 per cent.) If during period of postponement any moneys are available for payment of interest on said debenture stock, such moneys are to be applied for that purpose.

Dowsing Radiant Heat Co., Ltd.—Mortgage of contract moneys, dated September 6th, 1918, to secure all moneys to become due from the company to the London, Provincial & South-Western Bank.

Chile Telephone Co., Ltd. (29,252).—Capital, £360,000 in £5 shares. Return dated August 1st, 1918. 66,000 shares issued. £220,000 paid; £110,000 considered as paid. Mortgages and charges: Nil.

CITY NOTES.

Southern Brazil Electric Co., Ltd.—Mr. E. H. Tootal presiding at the annual meeting, said that the business had been restricted by war conditions. The gas works at Campinas were shut down in consequence of inability to obtain coal, but as it was being carried on at a small loss they had no reason to regret the cessation of that service. The old consumers would now be supplied with electricity instead. The receipts from the Campinas tramway service had suffered from several causes. The electrification of the steam railway, of which only a small part still remained to be done, should now be soon completed. The new municipal concession at Itapira was giving very satisfactory results, and the same could be said of the other small stations. They had a sufficient volume of water during the year, and on completion of the new Jaguary station their capacity for supplying power would be materially increased.

Victoria Falls and Transvaal Power Co., Ltd.—Net earnings for the year ended December, 1917, £836,301. After providing £236,273 for interest and premium on debentures, £236,273 for depreciation and income-tax, &c., £262,766 remains as net profit, plus £72,425 brought forward, making £335,191, out of which £50,000 has been put to reserve. Two dividends, each of 3 per cent., less income-tax, were paid on the preference shares, and 5 per cent. on the ordinary shares, with a further and final dividend of 4 per cent., less tax, on the preference shares, which are entitled to share *pro rata* with the ordinary shares in the surplus profits distributed until the preference have received a total of 10 per cent. for the year. A balance of £97,690 is carried forward.

To be Struck off the Register.—Unless cause is shown to the contrary the following companies will be struck off within three months:—

Afflecks' Engineering Works, Ltd.
Alexandra Electrical & Engineering Works, Ltd.
Carleon Electrical Co., Ltd.
Electric Lamp Repairs Co., Ltd.
Lounge Electrics, Ltd.
Manchester Cable Co., Ltd.
Overseas Development Trust, Ltd.
Patent Lighting Co. (1915), Ltd.
Printex Accumulator Co., Ltd.
Universal Electric Canoe Co., Ltd.

Direct West India Cable Co., Ltd.—Net result of working, year ended June, 1918, balance £15,225, against £27,374 for the previous year. Interim dividend 3 per cent., free of tax, already paid; similar further payment now, leaving £12,525 to be carried forward. The cable was interrupted for a few days near Turks Island by a landslide. The insulation of the Bermuda-Turks Island section remains low. An increase in the amount to the credit of spare cable is accounted for by the purchase of new cable sent to Halifax during the year.

Halifax and Bermudas Cable Co., Ltd.—Net result of working for year ended June, 1918, balance £9,697, against £19,650 for the previous year. Interim dividend of 3 per cent., free of tax, already paid; similar further payment now, leaving £6,697 to carry forward. The cable has been interrupted on two occasions by anchor near Halifax, and quickly repaired, and on February 17th in deep water. The latter repair has not been effected owing to adverse weather and war conditions. The cable recovered is in a good state of preservation, and the trouble is evidently local and due to chafing.

Stock Exchange Notice.—The following securities are to be quoted in the Official List:—

County of London Electric Supply Co., Ltd.—10,578 additional ordinary shares of £10 each, fully paid (Nos. 105,001 to 115,578.)

Dundee, Broughty Ferry, and District Tramways Co., Ltd.—The profit for the past year (including £587 brought forward) is £5,117, out of which 3 per cent., less tax, is being paid on the ordinary shares, £1,000 is put to reserve, and £83 carried forward.

Cuba Submarine Telegraph Co., Ltd.—Interim dividend on the ordinary shares for the June half-year at the rate of 5 per cent. per annum, free of tax.

STOCKS AND SHARES.

Tuesday Evening.

The course of Stock Exchange business runs strongly in favour of industrials of all kinds, where speculation is rearing its head, and any share which offers a reasonable scope for a "run for the money" is assured of popularity. One kind of patriot argues that he prefers shares which do not pay a dividend, because if they go up and he sells them at a good profit, there is no income-tax to pay on the transaction. It is said in the Stock Exchange that quite a large amount of the buying now afoot can be traced to provincial towns where munitioners are making large money, and turn their attention to Stock Exchange flutters by way of a diversion from their everyday work. Probably there is more than a modicum of truth in this, because, to judge from the way in which some industrials are being run up, the buying is indiscriminate, and at the same time widespread.

With the unconditional surrender of Bulgaria, and the fine news from other Fronts, markets as a whole are in a very cheerful frame of mind. Home Railway stocks have benefited with the rest, and amongst Undergrounds, Metropolitans recovered ¾, and the deferred dividend stock rose to 25, Underground Income Bonds gained a point, and the £10 shares at 2⅞ are ¼ up. Nearly all the steam stocks have thrown off the depression caused by the recent strike, and, although business is not stimulated to any noticeable extent, the tone is once more comparatively firm.

The market for home electricity supply shares is steady, and even those who have been most cautious in their views respecting the industry are beginning to express hopes that a turning in the long lane of depression may be at last within sight, and that the public before long will take an interest in these shares for post-war prospects. The observer of the market is not inclined to quarrel with such sentiment, but at the same time it is impossible to avoid the reflection that the reduction in dividends, which seems likely at the end of the present 12 months, will hold down prices for some time to come yet. City of London Ordinary are ¼ up at 11⅛, and Westminsters maintain their rise at 6½. Meanwhile, the manufacturing shares are quiet without developing any pronounced tendency. Ediswans are the feature, rising to 16s. 9d. after being 15s. 3d. The "A" shares 12s. paid are officially quoted at 5s., the first preference changed hands at the end of last month at 21s. 9d., and the 5 per cent. second debenture stock, which is not quoted in our lists, has risen recently to 73½, which, it may be noted, is 10 points above the quotation that ruled upon the outbreak of war. The first debenture at 75½ is 16½ points up from that time. British Aluminiums, now quoted ex the dividend of 9½d. per share, have risen to 37s. 6d., the company's 6 per cent. non-cumulative preference are also ex dividend, and stand at the relatively high price of 19s., while the 5 per cent. prior lien debentures at 88, and the debenture stock (5 per cent. minimum) at the same level are both firm. The last-named is in receipt of 5½ per cent. interest at the present time. British Westinghouse preference have gone back 1/16. British Insulated at 2¼ are practically unchanged, allowing for deduction of the dividend of 9d. last Friday, and the company's 6 per cent. preference shares stand at £1, which seems high enough in view of the yield offered by the National War Bonds.

Having regard to the good prices commanded by many of the best-class industrial shares, of which the electrical list affords a fair number of examples, it would seem to be worth while to sell these in order to put the money into the War Bonds at the present juncture. The latter return 5¼ per cent., allowing for premium redemption, and where preference shares can be sold on a 6 per cent. basis, there appears to be little object in holding the latter. It is arguable, of course, that the buyer of the preference shares might just as well be exhorted to put his money into War Bonds as the seller is, but, from the business point of view, the post-war outlook is sufficiently uncertain to render the 6 per cent. return on any preference shares, however good, an insufficient yield considering the liability of the price to fall away later on, while, on the other hand, there can be no decline in the War Bonds, seeing that they are repayable at a premium within short dates.

Marconis continue to be one of the most active shares in the Stock Exchange. The market is buoyant, and, although there was a little profit-taking which reduced prices from the top, an under-current of strength is so noticeable that each bout of profit-taking is easily met. Possibly, Marconis are high enough at the present time, and 4 13/16 looks a giddy price to pay for these £1 shares, notwithstanding the huge scope that there is for the company's future. The subsidiaries are as strong as the parent shares, Americans spurting to 34s. 6d., while Marines have jumped to 72s. 6d. Canadians improved a little to 15s. 6d., and Spanish at 16s. are also harder.

Telegraphs are steady as a whole, Anglo-American preferred rising to within half a point of par. Westerns continue their weekly rise, with another ¼ to their credit at 16¾. The telegraph manufacturing shares show no particular change, and the rubber share market remains quiescent. There has been a fresh demand for chemical issues of all kinds, in which Castner-Kellner participated with 1/16 rise. Babcock & Wilcox recovered to 3¼ after their somewhat sharp reaction. Victoria Falls ordinary rose to 20s. on the publication of an excellent report, and the preference keep hard at 24s. The Stock Exchange is greatly interested in the suggestion that the whole of the American railroads should be electrified, and that the work should be put in hand irrespective of the end of the war. Now that the Government has control of the railroads, it is urged that the present offers a favourable opportunity for making the change, which would involve the saving of vast quantities of coal.

Brazilian Tractions have advanced sharply, and Mexicans are also better here and there. Kaministiqua Water fell 3 to 114½, while Shawinigan Water at 122 is a couple of points to the good.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1916.	Dividend 1917.	Price Oct. 1, 1918.	Rise or fall.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	9	10	6⅝	—	£7 17 0
Charing Cross Ordinary	5	4	3½	—	6 8 0
do. do. 4½ Pref.	4½	4½	3⅝	—	6 18 6
Chelsea	3	5	3⅛	—	7 16 10
City of London	8	8	11⅛	+ ⅛	7 0 8
do. do. 6 per cent. Pref.	6	6	9½	—	6 3 1
County of London	7	7	8¼	—	7 1 9
do. do. 6 per cent. Pref.	6	6	9½	—	6 3 1
Kensington Ordinary	6	7	5¼	—	6 17 7
London Electric	Nil	Nil	1½	—	Nil
do. do. 6 per cent. Pref.	4	5	3½	—	7 13 10
Metropolitan	3	4	3⅛	—	6 10 7
do. 4½ per cent. Pref.	4½	4½	3½	—	6 18 6
St. James' and Pall Mall	8	9	6¾	—	6 18 6
South London	5	5	3	—	6 13 4
South Metropolitan Pref.	7	7	20/6	—	6 16 7
Westminster Ordinary	7	9	6⅜	—	7 7 0
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	90½	+1	6 0 6
do. Def.	1½	1½	23½	—	6 7 8
Chile Telephone	8	8	7½	—	5 6 8
Cuba Sub. Ord.	7	7	10½	—	*6 13 4
Eastern Extension	8	8	15⅝	—	*5 2 5
Eastern Tel. Ord.	8	8	158½	—	*5 1 0
Globe Tel. and T. Ord.	7	7	14½	—	*4 16 5
do. do. Pref.	6	6	10½	—	5 17 1
Great Northern Tel.	24	22	38	—	5 15 9
Indo-European	13	—	57½	—	5 12 6
Marconi	15	20	4¹³⁄₁₆	+ ⅛	4 2 0
Oriental Telephone Ord.	10	10	8½	—	3 4 0
United R. Plate Tel.	8	8	7⅞	—	*5 3 3
West India and Panama	6d.	1/3	1⅜	—	*3 6 8
Western Telegraph	8	8	16½	+ ½	*4 15 7
Home Rails.					
Central London Ord. Assented	4	4	62½	—	6 8 0
Metropolitan	—	1	26½	+ ¾	3 16 5
do. District	Nil	Nil	25	—	Nil
Underground Electric Ordinary	Nil	Nil	2⅜	+ ⅛	Nil
do. do. "A"	Nil	Nil	7/-	—	Nil
do. do. Income	6	4	84½	+1	*4 14 8
Foreign Trams, &c.					
Adelaide Sup. 6 per cent. Pref.	6	6	4⅞	—	6 6 4
Anglo-Arg. Trams. First Pref.	5½	5½	3⅛	—	—
do. do. 2nd Pref.	5½	—	2½	—	—
do. do. 5 Deb.	5	5	68	—	7 7 3
Brazil Tractions	—	—	51	+2	—
Bombay Electric Pref.	6	6	102	—	5 11 7
British Columbia Elec. Ry. Pfce.	5	5	68½	—	8 11 0
do. do. Preferred	Nil	Nil	41½	—	Nil
do. do. Deferred	Nil	Nil	36½	+1	Nil
do. do. Deb.	4½	4½	67½	—	7 7 6
Mexico Trams 5 per cent. Bonds	Nil	Nil	50	+1	Nil
do. 6 per cent. Bonds	Nil	Nil	43	—	Nil
Mexican Light Common	Nil	Nil	28	—	Nil
do. Pref.	Nil	Nil	40	—2	Nil
do. 1st Bonds	Nil	Nil	61½	+ ½	—
Manufacturing Companies.					
Babcock & Wilcox	15	15	3⅜	+ 1/16	9 17 4
British Aluminium Ord.	10	10	1¼xd	+ 3/16	5 6 8
British Insulated Ord.	20	20	2¼xd	—	4 9 0
British Westinghouse Pref.	7½	7½	2⅛	— 1/16	5 9 1
Callenders	20	25	10½	—	5 19 1
do. 5 Pref.	5	5	4½	—	5 11 1
Castner-Kellner	22	20	3⅛	+ 1/16	5 8 4
Edison-Swan, "A"	—	—	⅝	—	Nil
do. do. 4 per cent. Deb.	4	4	75½	—	5 6 0
Electric Construction	7½	10	1¾	—	7 5 6
Gen. Elec. Pref.	6	6	10½	—	6 3 10
do. Ord.	10	10	18½	—	*5 8 1
Henley	25	25	2½	—	5 11 2
do. 4½ Pref.	4½	4½	4	—	5 12 6
India-Rubber	10	10	17½	—	*5 16 9
Telegraph Con.	20	20	47½	—	*5 1 0

*Dividends free of Income Tax.

THE DUTIES OF THE PROGRESS DEPARTMENT.

By W. J. HISCOX.

(*Continued from page* 293.)

The Foundry—The Smithy and Press Shop—the Tinsmiths and Coppersmiths.

(*g*) *The Foundry.*—The "creative departments," of which the foundry is the most important, in most factories, may be looked upon as the foundation of production, for the output of these departments determines not only the percentage of orders completed in accordance with programme, but also the aggregate output of the factory. Castings or forgings represent the measure of the job in the case of 90 per cent. of the total orders, for in the machining of these parts more and longer operations are involved than in the case of bar material. Apart from this, the casting, particularly, is the fabric of the unit, the other details being merely accessories, and work cannot be commenced in connection with the assembly of the unit until the most essential article is to hand.

In modern organised factories, extensions to buildings and plant are constantly being effected, to cope with the increasing volume of business; but these extensions in many factories are confined to the machine and fitting departments, the requirements of the foundry in this respect being quite overlooked. Yet it is obvious that, if it has been deemed necessary to extend the machine and fitting departments, it is just as necessary to extend the foundry in a like proportion, for increased orders mean an increased demand for castings, and the foundry which could only just meet the requirements of the shops in days gone by cannot be expected to meet the increased demand for castings which will automatically follow the extension of the machine shop unless the same facilities are given.

This distinction also occurs with regard to plant. The modern machine shop is equipped with the latest appliances, obsolete machinery being removed to make room for more efficient machines. The foundry, on the other hand, usually has to be content with what it already has in the way of moulding machines, despite the fact that machine moulding is practically the most essential factor governing rapid production.

The foregoing is written with a view to dispelling any illusions with regard to obtaining a progressive output from an obsolete foundry; it is obviously impossible for the Progress Department, no matter how well organised it may be, to do itself justice if one of the departments of the factory, upon which so much depends, is unable to meet the demands made upon it, through being insufficiently equipped.

As in the case of other departments, the Progress Department should give the foundry a date for the completion of all castings in connection with a specific order, time being allowed for the making of a new pattern where necessary, and all outstanding patterns should be watched by the progress man, to ensure these being in the foundry early enough for the date to be met.

The progress section leader must interest himself personally in all matters affecting foundry production. It is not enough for the machine shop chasers to attempt to hustle specific castings from the foundry, as and when they are required; indeed, this practice need not be indulged in at all if the section man is doing his duty. He must remember that the machine shop should always have sufficient castings available to carry on for at least three or four weeks, and he will, therefore, fix his delivery dates accordingly. A list of all castings on each order is kept in the Progress Department, as instanced in the article dealing with the Pattern Shop; and as this list also shows all the outstanding patterns, it is a fairly simple matter for the progress man to keep in touch with the foundry requirements and output. If this list is kept up to date, the progress man, when urging the completion of a specific casting, will know exactly upon what date the pattern was available, and will, therefore, be able to ensure that his demand is not impracticable.

A copy of every delivery note, showing thereon the department for which the casting is intended, should be sent by the foundry foreman to the Progress Department, or, as an alternative, an official sheet, enumerating the whole of the castings dispatched on any one day, should be sent, the works order number and the departmental destination being entered against each item. If this is sent in early on the day following the actual dispatch, each progress man can correct his list of outstanding castings, and thus know to within a few hours the exact position with regard to castings on any order.

The date given to the foundry by the Progress Department must cover, in addition to the making of the pattern and the actual casting of the article, the time required for trimming, sand-blasting, or pickling, and these points, therefore, must not be lost sight of by the progress man when estimating for delivery.

Any casting delivered from the foundry and scrapped subsequently, should be covered by a reject note issued by the Inspection Department, and a replace casting ordered. This will be treated as a new order by the Progress Department; but if the casting in question is the only one of its kind on the order, the new date should be arranged so that the new casting can be finished early enough to prevent any unnecessary delay in the delivery of the completed unit. On the other hand, if the rejected casting is one of many, the replacement should be rushed through, so that it may, if possible, pick up with the other castings on the same order at an early stage of machining.

(*h*) *The Smithy and Press Shop.*—These two departments may be treated as one for the purpose of this article, and the procedure adopted by the Progress Department is substantially that adopted in connection with the foundry. In this instance, however, a large proportion of the dies, &c., are already in existence, and these are not usually kept in a separate department, as in the case of patterns, but in the tool store of the department responsible for the production of the required part. The special tools are usually made in the tool room, which department has to cater for the needs of the entire factory, consequently it has been deemed necessary for the Progress Department to fix a date for their completion. A copy of each tool-room date affecting the smithy and press shop orders should be sent to those departments, so that the foreman will know when the special tools may be expected.

A forging and pressing list should be kept in the Progress Department, giving particulars of the parts required, the special tool numbers (if any), and the estimated and actual dates of delivery. For advising the Progress Department with regard to finished work, the procedure recommended for the foundry in this connection should be adopted, viz., a copy of each delivery-note, or a daily list of completed parts, should be sent to the Progress Department.

In some concerns, the press shop depends to a large extent upon the tinsmiths' department for the supply of sheet material, which is cut to convenient dimensions to suit the pressing machines. When this is the case, a copy of the tinsmith's date for the delivery of the material should be sent to the press shop by the Progress Department, the three dates in question, viz., for tools, material, and the completed article, appearing on the same form.

Tool castings and forgings should receive prompt attention, the Progress Department fixing dates for these, to allow the tool room ample time to complete the tool in accordance with programme.

(*i*) *The Tinsmiths' and Coppersmiths' Department.*—This department differs from the foregoing, owing to the fact that rough material, requiring subsequent operations in other departments, and also finished articles, are produced. This means that in many instances the Progress Department has to fix two distinct dates in connection with one order, and the progress man must, therefore, make himself acquainted with the particulars of the parts required. With regard to the sheet metal work required by the press shop, this has already been briefly dealt with under the heading of that department, and the same procedure should be adopted by the Progress Department with regard to parts requiring subsequent operations in the machine shop or elsewhere.

With regard to finished articles required in connection with the final erection of the unit, the same date as tha

given for the completion of the sub-assemblies in the fitting shop should be given, as this would ensure finished tinsmiths' and coppersmiths' work being ready when required. When the tinsmith or coppersmith has to fit his own parts to the unit in the course of erection, the time for this to be done must be arranged by the two departments concerned. If considered desirable, the Progress Department could either enter on the tinsmiths' programme the date given for the erection of the unit, or merely endorse the programme "As Required," leaving the Erecting Department to make the necessary arrangements. In all other matters the procedure recommended in connection with the other departments should be adopted.

(To be continued.)

TECHNICAL EDUCATION AND DISCIPLINE.

By "IMPERIAL."

Although everyone has grown accustomed to the fact that the war has changed everything, there are still many who consider that development and progress are impossible. It is an attitude similar to that of Julia, who, "Vowing she would ne'er consent—consented." It is fortunate that, since it appears to be necessary to say "We can't," the contradictory nature of the English mind makes us embark upon, and achieve, the impossible. A consideration of the enormous progress made in, say, electric furnaces, where the business is forty times what it was before the war, or of the fact that the Westinghouse and the B.T.H. have both developed a complete line of automatic contactor gear, to mention but two minor instances, shows that we cannot stand still. The world still rolls on, and where there is life there cannot be stagnation. It is idle, then, to contend that every reform must wait until peace is declared—we shall be far too busy then re-adjusting our perspective to try any gigantic changes.

In the question of education, one advance has been made—there is a President of the Board of Education who is professionally interested in the subject, and who devotes his energies to the work of his department, instead of to militant politics. This is an improvement on the days when Mr. Arthur Henderson held the post so that he could be in the Cabinet without being distracted by the cares of an executive department—an elevation of education to the level of the Duchy of Lancaster!

Many alterations have been made since this desired change occurred—the status of the teaching profession has been greatly advanced, and the remuneration made more adequate to the talent demanded. More will be done when the new Bill becomes law, but in the higher branches of technical education there are many things that it would be difficult for Mr. Fisher to enforce, but which could easily be started from within. During war-time, when the youth of the country becomes liable for military service in its nineteenth year, the time left for University work is short. In London, since the earliest age for matriculation is 16, the time left is two years. It would be deplorable if, because of this, all the boys ready to leave school stayed on in a supernumary capacity, as a senior form. They would waste time, and inevitably acquire "swelled heads." It would be worse if they all ceased training altogether; and yet in most colleges the course covers three, and often four, years. Some effort should be made to provide a condensed intensive course, always avoiding "cramming." The fundamentals of the profession could be thoroughly instilled without the mind being overloaded by details, which, in the subsequent military training, would be at first useless, and at last forgotten. To provide a thorough grounding even in the fundamental essentials would, however, in the brief time, demand much more work than most technical—particularly engineering—students at present accomplish. They must work harder and longer—longer hours per day, with shorter vacations—or else college vacations largely occupied on some definite work. The longer hours are not difficult to obtain—every elementary school in the country starts at 9 or 9.30. Every secondary school starts at much the same time. Why should nearly every college start at 10 o'clock? Not one in fifty of the students does a stroke of work before coming to college, and it breeds and encourages late hours and lazy habits. When at college I found, and said, that I did my best work between 10 p.m. and 1 a.m. It was partly true, partly a convenient fiction to cover the fact that I wanted the hours until ten for lighter occupations than the theory of machines or the intricacies of rotary converters. But even if wholly true, it might have led to deplorable physical results, and it certainly fostered a taste for bed in the morning hours. If colleges commenced at 9 o'clock students could not stay in bed until 8.30 every morning, and a consistent effort to stay up until after midnight would soon prove a failure. It would reduce also the opportunities for philandering, which, though a privation for the individual, would not eventually be a loss to the nation.

Although it can scarcely be denied that longer hours would be an ultimate advantage to the student, it would impose an additional burden on the already depleted and overworked staffs. New recruits to the teaching profession are few, and must at present be physically unfit—a fact which excites little sympathy, and commands no obedience, from the average undergraduate of even the newer Universities. This does not constitute an *impasse*, however. Women are doing many things that were outside their sphere before the war, and there is no reason why they should not teach arts subjects, mathematics, and pure science in University colleges. This suggestion may occasion a howl of derision and dismay from staff and students alike; but let me assure them, from my experience, that the women who have adopted the profession of late years can, in many cases, do their hair and dress well, and have quite human ideas of amusement. They have also a well developed sense of their position and authority, and could maintain better order than some, at least, of the men whose lectures I attended.

But strict discipline is necessary, whether women are teaching or men. When a boy is in school he is subject to strict rules—even if they be enforced by prefects. When he arrives in college he is treated as a man and freed from restraint to an absurd degree. The effect of this is worse than that of the late hours. It is supposed to generate a spirit of self-discipline and independence. Which of these it was that caused an incident wherein the principal of a certain college returned one afternoon to find suspended on his door a length of chain and a porcelain handle, with a legend exhorting him to "Pull and let go," it is not for me to say. The only disciplinary measure in this case was that two men were carpeted, and one suspended for the remainder of the week—which, as his parents were in India, and he was living alone, troubled him but little.

When the student leaves college he runs up against a sterner discipline—especially now that he goes into the Army. But even in the old days, when he went into the shops, he found he was not the lord of creation he had believed. A lot of nonsense is knocked out of him then—but why should it ever be bred? He could gain a sense of responsibility, and, at the same time, of the necessity of instant and implicit obedience to the command of a superior, as easily as he now obtains his ideas of omniscience and omnipotence. He could gain the desirable characteristics by good discipline. Unfortunately, the word is generally misunderstood, and, if used in connection with men in a works, provokes talk of "Prussianism" and "dragooning." Neither of these is an essential part of discipline—they are merely inferior substitutes. But even they are better than nothing. Discipline and earlier hours are, however, essentials not only in war, but in peace time also.

The earlier hours need not stop after college. A few firms realise that early and short hours give advantages to both staff and employers, but many do not. The same works manager who in Manchester referred to the Ford organisation as "Prussianism and dragooning," once said that the work done per day by a technical engineer was directly proportional to the number of hours he worked. This is hardly a tenable theory—it at least does not hold true at the limiting value.

It is little hardship on any man to arrive at his office by 9 o'clock—if he works his hardest he is of little use after 5.

Consistent concentration on one subject over longer hours than these must produce staleness and mental fatigue; but the man who is free outside those hours can live farther from his work and get more variety of scenery, live a healthier life, and have a change of occupation in his home life. At the present moment it also aids in daylight saving and economy of fuel. But the point of permanent value is the better life of the individual and its consequent beneficial reaction on the life of the nation. Such a life would leave the experienced business men with time and energy to devote their attention to local and Imperial Government, instead of leaving it to professional politicians and journalists.

But, even apart from these points, the earlier hours are an essential to our national progress and to our healthy national, mental, and physical life. Now, when men are working with women and untrained assistants, their labour is far more intensive and fatiguing. Many a man is keeping his own card indexes, and doing clerical work he would never have touched three years ago—there are still employable but unemployed women who could do it for him. He may do it better than they, but his hours are excessive if he does it all, or else he neglects his proper business.

Probably the best hours for a man to work are from 9 until 4.30, with only half an hour for lunch. He would then not have time to eat or drink too much at mid-day, and would be far less sleepy in the afternoon. That, however, is a matter of opinion and of detail. The national interest demands that we should attend to the broad principles of the matter, and carry out at once the reforms that are urgently needed. We are a nation at war, and each must do his best. To do that he must work under the best conditions possible. Moreover, it is a sacred trust to those who are fighting for us that the world to which they return must be better than the old. Reconstruction cannot be relegated to a post-war problem. It must be done by us now, quickly, so that there is an adequate recompense to those who return, for all they have suffered.

A D.C. GENERATOR FOR CONSTANT PRESSURE AT VARIABLE SPEED.

In a paper by S. R. Bergman (*Journal* of the A.I.E.E., Vol. 37, No. 8), what is stated to be a new solution of this problem is presented. The advantages of the machine described are: the machine is self-excited and regulates independently of speed and load; it may be compounded; no external regulating device is used; the regulation is instantaneous and is approximately independent of the heating.

Fig. 1 illustrates, diagrammatically, the principle of the machine. The armature is series wound, and the field contains twice as many poles as the number of poles for which

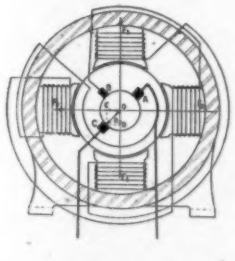


Fig. 1.—Constant Pressure Generator.

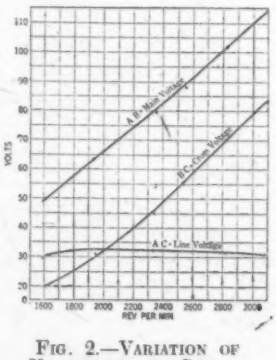


Fig. 2.—Variation of Voltages with Speed; 1.5 kw., 32-volt, 1,600/3,200 r.p.m. Generator.

the armature is wound. In the case illustrated, the armature is wound for two poles and the field contains four poles, symmetrically located. The load is taken from the brushes A and C and a third brush B is placed 90 electrical degrees from the load brushes.

The field may be considered to consist of two independent magnetic circuits, one of which circuits F_1 is saturated, and the corresponding flux ϕ_1 is called the main flux of the machine. The second magnetic circuit F_2 is not saturated, and the corresponding flux ϕ_2 is called the cross flux. The flux ϕ_1 generates, between the brushes A and B, an E.M.F. which is called the main voltage of the machine. The flux ϕ_1 does not generate any E.M.F. between the brushes B and C. Similarly the flux ϕ_2 generates, between the brushes B and C, an E.M.F. which is called the cross voltage. This flux does not generate any E.M.F. between the brushes A and B. The excitation of the machine is taken from the brushes A and B, for which reason the brush B is called the exciting brush. The excitation consists of two multiple branches, one branch exciting the main poles and the second branch exciting the cross poles. The two fluxes ϕ_1 and ϕ_2 are entirely independent of each other, which may be verified by separately exciting the machine, and tests show that if the main excitation is varied only the main voltage is affected, the cross voltage remaining constant; and if the cross excitation is varied only the cross voltage is affected, the main voltage remaining constant.

The directions of the main and the cross fluxes are such that the difference between these fluxes is interlinked, with the line brushes A and C, as shown in the figure, and thus the line voltage AC is the difference between the main voltage AB and the cross voltage BC. Hence, the voltage AC = AB − BC. Since the main circuit is saturated the flux

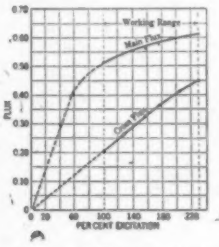


Fig. 3.—Fluxes Against Excitation.

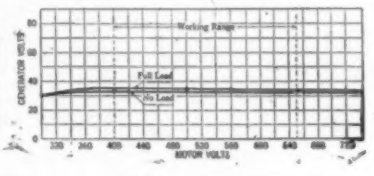


Fig. 4.—Generator and Motor Voltage Variation on Test.

ϕ_1 remains constant and the main voltage AB is proportional to the speed. Therefore, the excitation of both the main and the cross fields is proportional to the speed. The cross circuit not being saturated the cross flux ϕ_2 will increase in proportion to the speed, and, hence, the cross voltage BC must increase with the square of the speed. The cross circuit should not be entirely unsaturated, since then the cross voltage would increase too fast and the machine voltage would decrease with increasing speed. The cross flux should approach saturation, and it is possible to choose the saturation of the cross magnetic circuit, so that the line voltage AC remains constant. In fig. 2 is shown the variation of the different voltages with the speed. Since the excitation is taken from the brushes A and B the variation of the exciting ampere-turns follows the main voltage AB and may, therefore, in proper scale, be read from the curve AB. From

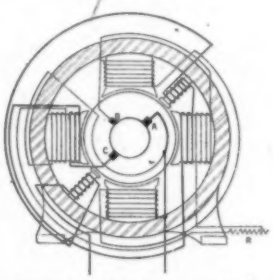


Fig. 5.—Complete Diagram of Connections.

these curves may be determined the amount of flux in each magnetic circuit for any given excitation, and in fig. 3 are plotted the two fluxes against the excitation. These saturation curves show that over the working range the main magnetic circuit is nearly saturated and the cross magnetic circuit at first is unsaturated, but from a certain point, where the curve bends, this circuit starts to approach saturation.

Since the line current is taken from the brushes A and C (fig. 1), there exists an armature reaction OR in the direction of AC. This armature reaction may be resolved in two components, one OD in the direction of the main flux, and the other OE in the direction of the cross flux. The main magnetic circuit being saturated, the additional excitation, due to the armature reaction, cannot add anything to the main flux. The component OE in the direction of the cross flux will, however, interfere with this flux, and would disturb the regulation of the machine. In order to overcome this influence a series winding is added to the cross poles; this winding should have an equal and opposite strength to the armature reaction working in this direction, and is called the compensating winding. The location of this winding is shown in fig. 5. By changing the strength of the compensating winding it is possible to obtain either rising or falling

machine voltage with increasing load. By over-compensation the voltage will rise with the load, and with under-compensation it will fall. The strength of the compensating winding can be made to compensate for the IR drop resulting in a flat compounded generator.

If a generator of the type under consideration is coupled to a motor, such a motor-generator is capable of transforming from a variable voltage to a constant voltage. Fig. 4 shows the performance on test of a motor-generator, the motor voltage varying from 400 to 650 and the generator voltage being maintained constant at 32 volts. As will be seen from fig. 4 the generator voltage rises slightly with the load, showing that the machine is over-compounded.

If the motor of a motor-generator of this type be thrown directly on the line a voltmeter connected to the generator shows that the voltage, due to sudden acceleration, exceeds the rated voltage. The amount of this over-shooting of the voltage depends upon the relative values of the time constants of the two multiple exciting circuits. For example; assuming that the rate of increase of the exciting current is nearly the same in both circuits then the flux in the unsaturated circuit will appear at a later time than in the saturated circuit. Consequently the negative voltage will not develop fast enough, resulting in the phenomenon which may be called over-shooting of the voltage. It is possible, however, to speed up the rate at which the cross magnetising current increases by the insertion of resistance in this circuit. The complete diagram of connections is shown in fig. 5, in which the permanent resistance is designated as R. Tests have demonstrated that if this resistance is properly chosen it is possible to entirely eliminate over-shooting of the voltage. In this figure there have also been added commutating poles to ensure perfect commutation.

The resistance R also serves another purpose, namely, to keep the regulation of the machine approximately the same when the generator is cold as when hot. Assuming that the generator was built in accordance with fig. 5, without any resistance in the cross circuit, it is obvious that when the generator is cold the current in both exciting circuits will be larger than when hot. The main flux will not be influenced by this increased excitation, since saturation exists. On the other hand, the increased exciting current of the cross circuit will cause an increase in the cross flux resulting in an increase of the cross voltage. Since this voltage is negative it follows that when the machine is cold the line voltage will be too low. By inserting a resistance of zero temperature coefficient the variation of the cross excitation is limited, and tests show that if the resistance R is approximately ⅓ or more of the resistance of the cross exciting circuit, the change of excitation, due to heating, will be limited to such an extent that the variation of voltage is less than 5 per cent., corresponding to a temperature range of 100 deg. C.

This generator is in reality a combination of two independent generators, one boosting the other; the machine must, therefore, be somewhat larger in size and weight than a standard machine of the same speed and output. On the other hand, there are several other conditions which tend to make this machine more economical than the standard. When the speed increases all flux densities and hence the stability increases. In a machine of standard make in which the shunt excitation is regulated in order to maintain constant voltage, the flux densities and hence the stability decreases with increasing speed. Therefore, a standard machine requires much larger gaps than this new machine and, furthermore, the armature reaction in the standard machine must be chosen with due consideration to the speed range. In order to give an approximate idea of the size and weight of this type of generator, as compared with the standard type, it may be stated that by a sacrifice in the efficiency of approximately 10 per cent., the new machine will have the same weight as a standard type of the same rating. This type of constant potential generator shows some distinct advantages over a standard generator with automatic voltage control. Where reliability of service is concerned this new type is claimed to be superior, since there are no automatic devices for maintaining the regulation. The new machine has also the advantage of being instantaneous in action, even at violent and large speed variations. Therefore, it is thought that this new machine will satisfy a long-felt need in certain applications of the electrical industry.

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

15,000. "Electric igniting devices." E. G. Pulford. September 16th.
15,042. "Temperature indicators for transformers, &c." British Thomson-Houston Co. (General Electric Co., U.S.A.) September 16th.
15,045. "Electric switch." R. K. Damey. September 16th.
15,052. "Ignition magnetos for internal-combustion engines." M-L. Magneto Syndicate & E. A. Watson. September 16th.
15,073. "Alternating-current switches." W. J. Higgs & D. D. Rayner. September 17th.
15,093. "Means for generating electricity." G. W. Muir. September 17th.
15,094. "Electric signalling telegraph." W. F. Grafton. September 17th.
15,102. "Converting sea and river tides into continuous power for generating electric current, &c." R. Potter. September 17th.
15,104. "System of production of undamped electrical oscillations for wireless telegraphy." F. Sepulchre. September 17th.
15,123. "Automatic or semi-automatic exchange systems." D. A. Christian. September 17th.
15,124. "Energy meters for alternating electric current." Fabrique des Longines Francillon & Co. September 17th. (Switzerland, September 17th, 1917.)
15,153. "Dynamo-electric machines and motors." W. Aldred. September 18th.
15,187. "Electromagnetic switches." British Thomson-Houston Co. & H. C. Hastings. September 18th.
15,188. "Electric heating devices." British Thomson-Houston Co. (General Electric Co., U.S.A.) September 18th.
15,193. "Sparking [illegible] internal-combustion engines." Soc. Clerget, Blin et Cie. September [illegible]. (France, September 19th, 1917.)
15,197. "Electromagnetic recording apparatus for telegraphic circuits." J. S. Withers (K. C. Cox). September 18th.
15,214. "Electric power supply systems." C. R. Woodland & R. Woodland. September 19th.
15,228. "Switch for closing electric circuit for certain period." Aktiebolaget Mekano & H. A. Schiefeler. September 19th.
15,230. "Means for making sealed joint between wall of vitreous material and electric conductor which passes there through." G. C. Chiljoti and Osram-Robertson Lamp Works. September 19th.
15,235. "Electrical apparatus for transmitting motion step-by-step to receiver." A. Barr, Barr & Stroud and W. Stroud. September 19th.
15,243. "Electrical boring machine." P. Elmedaard & E. Sorensen. September 19th.
15,277. "Electric accumulators or secondary batteries." E. J. Clark and Hart Accumulator Co. September 20th.
15,280. "Control gear for electric motors." J. Lewis. September 20th.
15,299. "Magnetic devices for detection of submerged objects or firing of mines." H. Gerrard & G. F. Partridge. September 20th.
15,301. "Detection of conducting bodies submerged in electrolyte." A. G. Ionides. September 20th.
15,303. "Electric furnaces." P. W. Fawcett & J. R. Hoyle. September 20th.
15,306. "Devices for detachably connecting electric conductors to terminals of magnetos, &c." A. G. Harding & G. F. Joseph. September 20th.
15,320. "Electric furnaces." British Thomson-Houston Co. (General Electric Co., U.S.A.) & H. Gerrard. September 20th.
15,345. "Electric blast furnaces." J. Bibby & J. O. Bovino. September 20th.
15,346. "Telephone transmitters." Western Electric Co. (Western Electric Co., U.S.A.) September 20th.
15,353. "Holders for incandescent electric lamps." J. B. Belcher. September 21st.
15,367. "Electrically-heated warming or cooking plates of the enclosed type." F. P. Fletcher. September 21st.
15,375. "Telephone switching apparatus." Automatic Telephone Manufacturing Co., J. Savin & R. R. Wade. September 21st.
15,402. "Electrical apparatus." A. M. Low. September 21st.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1917.

4,118. Electric welding machines. G. Gandolfo. March 21st, 1917. (118,422.)
5,617. Ignition magnetos for internal-combustion engines. J. E. Malivert. April 28th, 1916. (106,482.)
8,740. Electrically-heated cooking stoves. C. W. Winterbotham. June 18th, 1917. (118,423.)
9,489. Treatment of magnetic material suitable for use in static transformers and other electrical apparatus. A. F. Berry. June 30th, 1917. (118,425.)
11,860. Ignition magnetos. A. R. J. Foster. August 17th, 1917. (118,432.)
12,191. System for the protection of three-phase alternating current systems. R. J. Jensen. August 24th, 1917. (118,437.)
12,303. Electric motors coupled with compressors or pumps. W. J. Sturgess. August 27th, 1917. (118,445.)
12,427. Ignition devices. E. C. R. Marks (Splitdorf Electrical Co., U.S.A.). August 29th, 1917. (118,458.)
12,456. Electrical switches. H. W. Cox. August 30th, 1917. (118,459.)
12,566. Electrical accumulators. C. H. Worsnop. September 1st, 1917. (118,464.)
13,193. Automatic telephone central-station apparatus. A. E. Stevens. September 14th, 1917. (118,478.)
14,458. Electromedical coils. M. H. Goldstone. October 6th, 1917. (118,494.)
16,263. Railway signalling. McKenzie, Holland & Westinghouse Power Signal Co. (Union Switch & Signal Co., U.S.A.) November 7th, 1917. (118,513.)
16,968. Starters for internal-combustion engines. A. H. Midgley and C. A. Vandervell & Co. November 16th, 1917. (118,519.)
16,931. Carbon brushes and brush-holders of electric motors and generators. Veritys, Ltd., & C. R. Ailen. November 17th, 1917. (118,520.)
17,091. Induction coils. M. A. Codd. November 20th, 1917. (118,534.)
18,283. Electric current controllers. G. Ellison & J. Anderson. December 10th, 1917. (118,536.)

1918.

861. Electric fans. British Thomson-Houston Co. (General Electric Co., U.S.A.) January 15th, 1918. (118,546.)
4,044. Circuit breakers for ignition magnetos. Labrosse & Esteve. September 6th, 1917. (118,393.)
4,353. High-tension electric fuse. A. Nielson. April 12th, 1917. (114,831.)
4,374. Dies for shaping insulators and the like. H. O. Busch-Jensen. March 12th, 1918. (118,563.)
7,722. Protective devices for electric circuits. British Thomson-Houston Co. (General Electric Co., U.S.A.) May 8th, 1918. (118,578.)
8,978. Electrical fuse carriers. A. C. Robinson & A. C. Checketts. May 31st, 1918. (118,584.)
9,751. Control of electric motors. British Westinghouse Electric and Manufacturing Co. June 13th, 1917. (116,393.)
9,976. Electrical condensers. Philips-Brinton Co. July 20th, 1917. (118,090.)
11,474. Timing mechanism for ignition systems. Bosch Magneto Co. September 26th, 1917. (118,587.)